THURSDAY, AUGUST 3, 1876

OUR OYSTER FISHERIES

THE Select Committee appointed by Parliament "to inquire what are the reasons for the present scarcity of oysters," have issued a short but very sensible Report on the Oyster Fisheries, containing a recognition of the fact that the supply of oysters has for some years steadily decreased, and laying down recommendations for the future regulation of natural *scalps*. The Committee have not given much weight to the "theory of heat and tranquillity," which some naturalists consider essential to the fertile *spatting* of the oyster, but have come to the conclusion that the principal cause of the diminution of our once plentiful supply of oysters is to be found in the continual over-dredging for them in open waters, without allowing any sufficient "close time." In France, as the Committee have found by making careful inquiry, the regulations which hedge round the close season are stringently observed, and in consequence of that exercise of vigilance, the supply of oysters has increased; the Committee therefore recommend that a "general close time" (? for *open waters*) should be established, and that it should extend from May 1 to September 1. This is just the old popular close time, as it used to be considered that oysters were only good for food in the months which had the letter *r* in their spelling—the months from September to April inclusive.

With regard to this regulation of a "general close time," the Committee offer the suggestion, that it ought in some degree to be *permissive*, as there are portions of the sea, especially the estuary of the Thames, where it is doubtful whether any close season for dredging would be required; therefore, power ought to be given to the Board of Trade, after inquiry, to shorten, vary, or determine this close season in any particular case. It is also a recommendation by the Committee that the Board of Trade should have authority in certain districts to prevent dredging for a given time. As regards the deep-sea oyster fisheries, the Committee do not propose any alteration of the present close time, which extends from June 15 to the end of August. The infliction of penalties for buying or selling oysters for consumption during the close season is recommended. The proposed regulations, it is thought, should be enforced under the superintendence of inspectors aided by the services of the Coastguard. The Committee approve the practice of giving grants of foreshore and of sea-bottom to private individuals and companies for the purpose of breeding and feeding oysters.

These recommendations of the Select Committee will, in all probability, be introduced to the House of Commons next session in the shape of a "bill," which will probably in due time become law. The oyster is certainly one of our marine products which we can protect by means of a close time, seeing that the bivalve is a fixture and remains during its lifetime in one place, unless violently removed. There is one point in the economy of oyster life which has not yet been so thoroughly investigated as it ought to be, namely, the age when an oyster becomes reproductive. The period at which the oyster breeds might, we think, be set down with more certainty than it is at present. Some persons say it breeds in its third year; others, that it is not gifted with the power of reproduction till it is at least four years of age. It is a recommendation of the Committee that "no oyster should be sold from the deep-sea fisheries under 2½ or three inches in diameter;" such oysters, in our opinion, would not, on attaining that size, have reached the reproductive age; and it is a fact, we believe, that enormous numbers of the edible bivalve reach the market before they have had an opportunity of reproducing their kind, which is, of course, one cause of the present scarcity. It is laid down as a rule by those practically engaged in the cultivation of oysters, that oysters transplanted for fattening purposes do not breed, or, to put the case in other words, do not get an opportunity of doing so. It is perfectly obvious that, if a large per-centage of our oyster supply is sold before it has been given an opportunity of *spatting*, that that of itself, must tend to abridge the supplies.

At one time the French oyster growers were in danger of exterminating the oyster. From their eagerness to make money they rushed to the market with the produce of their artificial *parcs* before they had been afforded an opportunity of breeding! The natural *scalps* which produce most of the oysters laid on private fattening beds, never cease in their season to reproduce, but the *spat* which they exude does not always fall on proper bottom. Without a good holding-on place, a "coign of vantage," the infant oyster is of no account. It may get buried in a muddy bottom, or it may be landed high and dry by the waves of the sea on a place where it will assuredly die, or it may fall on good rocky or stone-covered ground, in which case only it will thrive. "Heat and tranquillity" are not at all necessary, in our opinion, to ensure a good fall of oyster *spat*, because the oyster obeying the laws of nature *spats* at its own season, and there are hundreds of oyster *scalps* yet to be discovered, which owe their formation and subsequent growth to the wafting, by the wind, of a "spot" of *spat* to some particular place, where the infantile bivalves find a holding-on place; a holding-on place is all that is necessary for the healthy growth of the oyster. This "theory" was promulgated in the *Times* newspaper some years ago, and we are not aware of anything having occurred since to prove it erroneous.

What is really wanted for the protection of the oyster is the assurance that these animals will not be sold before they have a chance of reproducing their kind. Since the introduction of the railway system, the demand for oysters in distant places has become so great, and the price has risen so high, that oyster culturists are tempted to send immature animals to market, and it is this fact, more than any failure of *spat*, that is leading to the scarcity. There are not, in consequence of the unceasing demand, and consequent high price, so many full-grown oysters left to *spat* as there ought to be, hence the scarcity. Any act of parliament that decrees two oysters to grow where only one grew before, will be greedily welcomed both by oyster culturists and by the public, and we hope that the issue of the present Report will lead to some effective measures being taken for the preservation of the delicious creature ere it be too late.

SMITH ON FERNS

Historia Filicum; an Exposition of the Nature, Number, and Organography of Ferns. By Jno. Smith, A.L.S., Ex-Curator of the Royal Botanic Garden, Kew. With Thirty Lithographic Plates by Fitch. 8vo, 429 pp. (London: Macmillan and Co.)

THE main and most valuable part of this work is a full account of Mr. Smith's scheme of fern-classification, with a complete catalogue of all the known species, arranged according to his views and diagnostic characters of all groups of a higher grade. The author is the patriarch of living fern writers, having worked at ferns with unwearied perseverance and enthusiasm for now upwards of fifty years. In 1823, when he first took charge of the living collection at Kew, it contained only forty species. Sir Wm. Hooker also, as is well known, made ferns his favourite department of botany for the last twenty-five years of his life. In 1846 the living collection had increased to 400, and in 1857 to 600 species. In 1864, when in consequence of failing eyesight Mr. Smith was compelled to resign his appointment, he estimated the number of ferns in cultivation in the country at upwards of 1,000. The whole number of species now known in the world, taking a broad view of what constitutes a species, is not far short of 3,000, and during the last year, certainly not less than fifty new ones have been added to the list.

The great peculiarity in Mr. Smith's plan of fern-classification is that at the outset he divides ferns into two groups, which he calls Desmobrya and Eremobrya, an account of which will be found at p. 65. The difference between them depends mainly upon whether the stipes are continuous with the caudex, or jointed at the base, so that they become detached when the frond withers, like the leaf of one of our deciduous trees. The Eremobrya, which are comparatively few in number, are such ferns as *Polypodium vulgare*, and *Davallia canariensis*, in which the fronds are produced singly from the sides of a creeping rhizome, and are jointed at the base. The Desmobrya, which are perhaps three quarters of the family, and have unjointed stems, may have either the fronds produced in a crown from the summit of an erect caudex, as in the tree-ferns and *Nephrodium Filix-mas*, or produced alternately in a single series from a creeping rhizome, as in *Pteris aquilina* and *Nephrodium Thelypteris*. These last, which are comparatively few in number, are like the Eremobrya in habit, but want the joint.

The old Swartzian and Willdenerian genera, founded upon the shape and position of the sori, and the absence or presence and position of the indusium, fall many of them partly into one of these groups, partly into the other, and this holds good also with ferns in which sori and veining also coincide. So that there are substantially three plans of fern-classification and fern-nomenclature, each of which is represented by a recent work in this country, and their relation to one another is as follows:—All systematists agree in recognising a substantial difference in the shape and structure of the sporangia, the shape and position of the sori, and the absence or presence of an indusium as constituting a genus. In Hooker and Baker's "Synopsis Filicum," now in its second edition, only genera are admitted which rest on these characters, and their number is 76, Polypodium, containing about 400, and Asplenium about 300 species. There is great variation in the arrangement of the vascular bundles in the fronds of ferns. Sometimes they do not join again after once branching. In other cases they join and form meshes of various shapes. A second school, represented in Britain by Moore's "Index Filicum," regard any appreciable difference in veining as constituting a generic character, and this increases the number of genera between two and threefold. The total number of genera admitted by Moore is 178, and of these, twelve go into the Polypodium of Hooker. Mr. Smith's plan carries us a decided step further in the direction of subdivision, and by using the character already explained as a ground of generic separation, raises the number of genera admitted to 220. But in point of fact all the ferns in which the sporange is surrounded by an incomplete vertical ring (Polypodiaceæ), which are three-quarters of the whole order, agree completely in the essential structure of their organs of nutrition and reproduction, so that a large proportion of the genera even of those that admit the fewest number are separated from one another by very unimportant characters, and the great difference that there is in the nomenclature of ferns according to the three different systems does not represent any deep-seated divergence of view, because the systematists of the first school willingly accept the further subdivisions of those that multiply the number of genera, as being the best possible groups that can be devised of subgeneric or sectional value. The book, therefore, is worthy of careful study by everyone who is interested in the subject; it is a complete gathering together in one view of the author's work in the field to which it relates. Remembering how the book has been written, no one can study it without strongly sympathising with the author in the difficulties under which he has rested in thus placing before the world the matured result of his labours, and admiring the energy with which he has achieved so difficult a task in such trying circumstances.

In the way of criticism we have two observations to make: the first, that whoever has undertaken the correcting for the press has done his work the reverse of well. Names of well-known genera, species, authors, and books are frequently misspelt. At p. 65 we have the essential character of Desmobrya made to depend upon venation, and at pp. 98 to 101 we have under both Niphobolus and Colysis all the three genders represented in the adjectival specific names. Secondly Mr. Smith, frequently under a genus, compares the number of species as given in Hooker's "Species Filicum" with that given in Hooker and Baker's "Synopsis Filicum," as if the two numbers represented the same thing. Under Adiantum, for instance, he expressly says that where Sir W. Hooker has made 109 species Mr. Baker has reduced them to sixty-two. He has evidently forgotten that, as was fully explained in the preface to the later work, the plan of the two books is different—that the more condensed "Synopsis" only includes the species known with certainty by the authors; but the "Species," in addition those that have been described by others, but not identified, a large mass of doubtful plants in addition to those that are known fully and clearly, so that the two sets of figures cannot be fairly compared unless this be constantly borne in mind.

J. G. B.

TURNER ON THE PLACENTA

Lectures on the Comparative Anatomy of the Placenta. First Series. By Wm. Turner, M.B. Lond. Pp. 122, Woodcuts, and Three Coloured Plates. (Edinburgh: A. and C. Black, 1876.)

THE anatomy of the Placenta has been studied by the best anatomists from Fabricius and Harvey to Hunter, Von Baer, and Sharpey; but much remained to be done when Prof. Turner took up the investigation; and those who are acquainted with his admirable memoirs, which lie hidden in the Transactions of the Royal Society of Edinburgh, know how much he has done to correct and extend our knowledge. The present volume contains a series of lectures delivered before the Royal College of Surgeons last year, and illustrated by specimens from their magnificent Hunterian museum, as well as from that of the University of Edinburgh. Prof. Turner has also been liberally aided by Dr. Sharpey, Mr. Huxley, and other anatomists with material, so that he is able not only to compare the placenta in man with that in the cat, bitch, cow, sheep, and mare, but also in the hyrax, elephant, seal, giraffe, alpaca, lemur, sloth, grampus, and narwhal. The present volume deals only with the diffuse, cotyledonous, and zonary forms of placenta; a second series of lectures will complete the subject by a similar discussion of the discoid placenta, and we shall then have the most complete monograph on this important structure which has yet appeared.

Prof. Turner begins with a short introductory account of the mucous membrane of the unimpregnated uterus, and especially of its glands, and of the chorion and other fœtal membranes. In describing the amnion, he gives the best account yet published of the curious brown or yellow appendages of this membrane found in various forms and in different species by Bernard, Owen, Rolleston, and others, which are probably identical with the "hippomanes" of veterinary surgeons.

The structure of the diffuse placenta in *Sus*, *Equus*, *Orca*, and other genera is then described. The villi of the chorion do not fit into the orifices of uterine glands, but into inter-glandular crypts, which do not exist in the unimpregnated uterus, and only appear as gestation advances. In Cetacea, as in the pig and mare, the villi do not persist over the whole chorion, but die off from the two poles, having only a certain amount of vascular tissue to represent the mesoblast of the allantois. But in the mare and the grampus there is also a third bare spot which corresponds with the os uteri, and is unrepresented in the pig. In the latter there are numerous bare spots scattered over the chorion, which were described by Von Baer and are now found by the author to correspond to parts of the uterine mucosa without crypts, and sparingly supplied with vessels. Dr. Turner has had the opportunity of dissecting two pregnant Lemurs (*Propithecus diadema* and *Lemur rufipes*), and finds that the form of the placenta in the former species is what M. Alphonse Milne-Edwards described as bell-shaped (*placenta en cloche*), *i.e.* the villi cover the whole chorion except at the os uteri; but in the Red-footed Lemur there are two other bare spaces at the poles of the ovum, so that the placenta *en cloche* is a mere generic, or accidental, variety of the diffuse form. Moreover, the villi came away from the crypts of the uterine mucosa in which they lay, without taking any maternal tissue with them. Thus the placenta of lemurs is neither discoid nor deciduate, and one more link of connection between this group and the true Primates is broken.

In his account of the placenta of the cow, Dr. Turner confirms the description by Von Baer and Weber, of the small pouches scattered over the chorion between the cotyledons, and is disposed to agree with the latter anatomist that they serve as receptacles for the secretion of the uterine glands during pregnancy. Similar "pocket-like" depressions were discovered by the author in the giraffe's placenta which was described by Owen in 1842. In this animal, as in the red deer, the cotyledons are arranged in longitudinal rows, and between them are not only much smaller tufts, but also short club-shaped villi, scattered separately or in minute groups over the chorion, which thus approximates to the diffuse form found in the camels and the chevrotains.

In the account of the deciduate placenta, the most important fact established by Prof. Turner is that there are several degrees in the amount of maternal tissue which is detached in parturition. If the ovum is stripped off the pregnant uterus of a cat, it carries with it the whole of the mucosa (decidua serotina) with which the chorion is in contact; but on careful examination of the placenta after its natural detachment at birth, it is found that a considerable amount of the vascular corium has been left behind, and that only the superficial part with the epithelial layer has come away with the chorion. In the bitch, as was pointed out by Prof. Rolleston in 1863, the placenta is still less "deciduate," for there is not enough mucosa detached with the ovum to form a continuous layer on the uterine surface of the placenta. Dr. Turner found that the placenta of a vixen agreed precisely with that of the bitch in this respect; the foldings of the uterine mucosa were so minute as to produce a reticulated structure of the placenta, and a similar arrangement was discovered in a specimen from *Halichoerus gryphus*. A re-examination of the placenta of the hyrax described by Prof. Huxley confirms his account of it, and contradicts the assertion of two French anatomists that it is non-deciduate. The poles of the chorion in the Carnivora are often well-supplied with blood-vessels, though no trace of villi can be found at full term beyond the equatorial region. In the otter and the weasel bare gaps occur in the placental zone, as described by Bischoff in 1865.

The most important points established by Prof. Turner seem to be the following:—

1. That the uterine glands are all compound and tubular, and cannot be divided into two groups, as they were by Sharpey, confirmed by most German anatomists. In this Dr. Turner agrees with Prof. Ercolani, of Bologna.

2. That the uterine glands do not open into the funnel-shaped crypts which receive the fœtal villi, but on the surface between them, and that the crypts are only developed during the progress of gestation. Here also the observations of Ercolani and of Eschricht are supported.

3. That the deciduate character is one of degree. The detached diffuse placenta consists entirely of fœtal structures; in the sheep and cow a large amount of maternal epithelium lining the walls of the uterine crypts comes off

with the ovum, and possibly some of the vascular corium in addition; and even in *Canidæ* and *Pinnipedia* less of the decidua comes away at parturition than in the cat.

4. That the secretion of the uterine glands is absorbed by the intervillous parts of the chorion, and serves as "uterine milk or chyle," the comparison originally made by Harvey.

The important bearing of these researches on the classification of Mammalia is obvious, and they suggest scarcely less important questions as to the nutrition and respiration of the fœtus. P. S.

OUR BOOK SHELF

An Elementary Treatise on Kinematics and Kinetics. By E. T. Gross, M.A., Fellow of Gonville and Caius College, Cambridge, &c. (London: Rivingtons, 1876.)

MR. GROSS says, in his preface to the book before us, that it "is intended to contain as much as is required, under the head of Dynamics, of candidates for honours in the first three days of the mathematical tripos." This object has no doubt determined to a great extent the form which the work has taken, and we see no reason to doubt that it is well suited for the purpose mentioned, and will prove useful to students working for Cambridge examinations. The first five chapters are devoted to the Kinematics of a point, the conception of Velocity being taken up at the outset, along with that of Motion; motion as change of position, and the theorem of the instantaneous centre is only briefly mentioned in a short chapter (the sixth) chiefly devoted to the "Geometry of the Cycloid." The remaining ten chapters of the book are given to Kinetics. The author has taken great pains to put the fundamental conceptions of his subject clearly before his readers, and the parts of his book most valuable to the general student will certainly be those in which he endeavours to crystallise the vague notions too often picked up, at the commencement of a study, as to velocity, force, &c. At the same time we must say that the arrangement of the book is not such as to fit it for general purposes as an elementary text-book on its own subjects. Perhaps this was unavoidable, considering the main object with which it was written, but it is certainly to be regretted. For most purposes it seems better to commence the study of Kinematics by considering motion as change of position only, leaving velocity to be brought in later. This certainly makes it more easy for the student to realise the matter, and obviates such difficulties as occur for instance at pp. 16 and 20, where "change of velocity" means in one place a change of velocity both in direction and in magnitude, and in the other a change in magnitude only. The same treatment also would allow of portions of the Kinematics of rigid bodies being taken up in an elementary manner, while in Mr. Gross's work this part of the subject, the most important one, is practically left untouched. No motion, in fact, is considered, except the motion of a point in a plane. The treatment by the method of instantaneous centres is merely mentioned, although the development of this method certainly furnishes excellent means for the elementary treatment of the more important problems connected with the kinematics of rigid bodies. Similar remarks might be made in reference to the second part of the work, but perhaps it is not fair to criticise from this general point of view a book written chiefly for a special and limited purpose.

Mr. Gross has used geometric illustrations freely and with great advantage throughout his book. We regret that he has adhered throughout to the *parallelogram* of velocities, forces, &c. Surely it is more elegant and in every way better to use three lines than five. Culmann's science can be very little known in this country if we have not yet got even as far as this.

LETTERS TO THE EDITOR

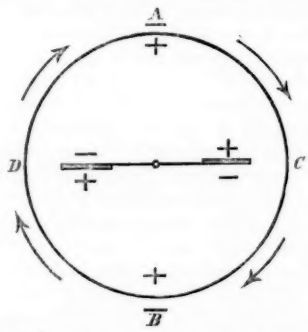
[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

The Direct Motion in the Radiometer an Effect of Electricity

I HASTEN to communicate to NATURE some new facts which are destined, I believe, to throw some light on the theory of the radiometer:—

1. The glass globe becomes negatively electrified upon the whole of its exterior when the instrument is submitted to solar, or even obscure heat radiations of sufficient intensity, and this electricity is more intense upon the hemisphere facing the radiant source than that opposed. It was by means of a proof-plane of large surface and a Bohnenberger's electroscope that I was able to determine the presence of this free electricity. By touching the globe several times in different places with the proof-plane, and then applying it to the electroscope, the effects are very sensible. This electricity cannot be attributed to the friction of the radiometer vanes with the rarefied air of the globe, since the electroscopic indications are not modified when the instrument is inverted, and the vanes thus prevented from moving. Neither, as several experiments show, can it be attributed to feeble evaporation on the exterior. This development of electricity upon the exterior surface of the globe is of course necessarily accompanied by the development of positive electricity upon the inner surface.

2. When exposed to radiation, the black face of the vanes is electrified positively, and the bright face negatively. This I have proved in the following manner:—I took a strip of mica two decimetres long, and having coated one of the sides with lampblack, I suspended it in a Coulomb's Torsion Balance, having previously electrified the metallic disc of the balance-needle with positive electricity. The blackened side faced the disc. I then



allowed the radiations from a gas-flame to fall upon the blackened surface of the mica strip. Notwithstanding the light was at some distance, and had to penetrate the thick glass shade inclosing the balance, the needle was rapidly repelled several degrees, showing that the blackened face was positively electrified under the influence of radiation. I then turned the strip of mica so that the bright side faced the disc and allowed the radiation to fall as before upon the blackened surface. The needle indicated an attraction between the disc and the mica, proving that the bright surface was negatively electrified.

3. To anticipate the objection that these electrical manifestations are too feeble to account for the rapid revolution of the vanes, I gently rubbed the globe with a brush composed of glass threads; the electricity developed on the globe acting by induction upon the nearest mica disc of the radiometer caused a brisk oscillation. I then measured the intensity of this electricity by means of the proof-plane and electroscope, and there were no indications of greater intensity then when the globe was electrified by radiation.

4. From the above facts the following theory, if I mistake not, necessarily flows. The radiometer is electrified as represented in the figure. At C the black face of the vane is turned towards the radiant source, and in this position the vane will be forced to move in the direction A C B; when it arrives at D, the direction of the rotation which the attractive and repulsive forces

necessarily produce will not change. It will be that indicated by the arrows, namely, B D A. The direct and ordinary movement in the radiometer is thus explained in the simplest manner.

JOSEPH DELSAULX, S. J.

11, rue des Récollets, Louvain, Belgium, July 22

A Brilliant Meteor

LAST Tuesday evening, July 25, at three minutes past 10 P.M., a magnificent meteor was observed here. Its first appearance was hidden from me by a tree, but the rest of its long course was open to view. It travelled straight from S. to N. between the directions S.S.W. and W. Its apparent size was that of Jupiter. When first seen it was of a brilliant violet colour. This changed to bright green and red, and towards the end it was, I think, green in front, red behind, and where a number of globules which broke off seemed to follow it. The body of the meteor was pear-shaped. No luminous train was left after its disappearance. The motion was much slower than that of common aërolites, and probably the phenomenon lasted about two seconds. It would be interesting to know what was seen of it in the West of England and in Ireland.

Pembroke Lodge, Richmond Park, F. A. R. RUSSELL
July 28

ON Tuesday, the 25th, I was seated with my eyes looking westward, when at 10.5 P.M. a most remarkable meteor passed before my vision, which exceeded in brilliancy of colour and in dimensions any phenomenon of the kind that I ever witnessed in the whole course of my life.

The main body of the meteor was a vivid emerald green, with a large spherical head tapering away into a tail of fiery red colour, followed up by a luminous track.

Its trajectory was almost horizontal, emanating from the constellation of Aquila, passing through that of Hercules, curving slightly downwards, and passing a few degrees beneath Arcturus; a short distance northward of that great star the meteor suddenly collapsed with a bright effulgency, and vanished from sight.

Its velocity appeared as being somewhat slower that what I have observed on similar occasions. It was present to the observer for more than five seconds of time, sufficient time to leave on the mind of the observer a distinct impression of the meteor's various aspects.

Owing to the dry condition of the atmosphere, the apparent proximity of the meteor was very striking; the brilliant flash of colour at first sight produced the effect that a large rocket had been fired off in the vicinity, for it was very similar in colouring and shape to many rockets displayed by pyrotechnists.

Soon after the meteor had disappeared I observed three very faint shooting-stars to fall from a high altitude downwards to the track which the meteor had taken.

I furnish you with these observations, which may interest your readers, especially those who were fortunate enough to observe this splendid phenomenon. ERAS. OMMANNEY

6, Talbot Square, W., July 29

D-line Spectra

LAST March you were good enough to publish in NATURE (vol. xiii., p. 366) a request for some explanation of the extremely different, and indeed opposite, reactions afforded to *boric acid* by the yellow or D-line spectral flame emitted from soda or its salts, and from platinum respectively, when treated with the blowpipe.

No explanation has been vouchsafed; and it may be now added to that fact that, among the millions of substances in nature emitting this D-line producing-flame when heated before a blowpipe, sodium salts are the *only ones* which give the reactions of sodium; all others affording extremely marked reactions of an *exactly opposite* character. W. A. ROSS

July 24

Pyroxidation

WILL any of your chemist contributors be so kind as to afford in your columns an explanation of the following phenomenon?

If we heat before a blowpipe on a piece of aluminium plate (which has a side of four inches perpendicular to the blowpipe flame) a fragment of pure antimony, we have three sublimates deposited on the perpendicular side of the plate in the following order:—

(*a*) Sb_2O_5 (strongly reddening litmus paper) *highest.*
(*b*) Sb_2O_3 (faintly " " " intermediate.
(*c*) A *black* sublimate (?) lowest.

I want to know why a substance similar to another, except that it contains two more atoms of oxygen, and has therefore a higher specific gravity, travels perpendicularly up the plate to a more elevated position? W. A. ROSS

July 24

ABSTRACT REPORT TO "NATURE" ON EXPERIMENTATION ON ANIMALS FOR THE ADVANCE OF PRACTICAL MEDICINE[1]

V.

Results of Experiments on Resuscitation.

IN my last communication I described a method of practical study by experimentation which was intended to demonstrate the best means of restoring to life those human beings who by accident are thrown on the confines of death. To thoughtful and feeling minds this study is sublimely solemn, but I see that a writer in one of the contemporaries of NATURE has found it possible, in his zeal against experimentation on animals, to make my observations on the subject the matter of a jest at my expense. In order to render his jest applicable, the writer has also perverted my statement so as to make a simple illustration of a discovered fact appear as if it were presented in the light of the fact discovered. It will be remembered by the readers of these articles that after I had described, in my last essay, the observations relating to the effect of galvanism on expiring muscular power, I enforced the lesson by illustrating the difference of effect that might be expected to occur from carrying an exhausted animal to a place of succour and of making it travel to the place. The writer I refer to states this illustration as the fact which I have arrived at by experiment, and thereupon founds his joke, which he borrows from *Gil Blas*. The circumstance of this criticism has an interest for which I am thankful. It has suggested to my mind something which might not have occurred to it, viz., that in my desire to be very brief in these abstract reports I have neglected to introduce a few detailed arguments of first importance, which ought not, perhaps, to have been omitted in any case, but which I am now compelled to supply.

After the discovery of the process known as galvanism, and the researches conducted by Galvani, Volta, and Aldini on the influence of the galvanic current on animal life, the application of the current for the purpose of resuscitating persons who were apparently dead became the common practice of medical men. The extraordinary experiments conducted by Aldini at the College of Surgeons during the day of January 17, 1803, on the body of a malefactor named Forster, made an impression on men of science which was probably without parallel. The malefactor, after being hanged and after being exposed for a whole hour to a temperature two degrees below freezing-point, was carried to a house near to Newgate, and, in pursuance of the sentence, was delivered over to the College of Surgeons. The master of the College, Mr. Keate, here re-delivered the body over to Aldini, who was the nephew and devoted follower of Galvani, and the action of the galvanic current upon the dead man was demonstrated. I need not describe minutely the strange phenomena that were observed during the demonstration. Carpue, the anatomist, took share with his pupil Hutchins in the anatomical part; Cuthbertson, an eminent mathematical instrument-maker, the Browning of that day, directed and arranged the galvanic apparatus, which consisted of three troughs of forty elements each; Mr. Keate took duty in observing, and Aldini directed the operations. Fifteen experiments were carried out, and such were the muscular movements excited in the dead man by the current that the most sanguine expectations

[1] Continued from p. 252.

were afterwards expressed as to the power of galvanism to restore suspended life. Aldini, indeed, made a kind of apologetic observation that his "object in applying the treatment to the dead malefactor was not to produce reanimation, but merely to obtain a practical knowledge how far galvanism might be employed as an auxiliary to other means in attempts to revive persons under similar circumstances." The observations of Aldini were as impressive as they were remarkable. They opened a new line of inquiry and of research; but in their very wonder lay a source of many errors, and from these errors sprang a false rule of practice, which was unfortunate in its results for a very long time.

One error consisted in attributing to the action of galvanism something more than its power of calling forth the natural remaining irritability of the muscles of those in whom the signs of life are suspended. It was noticed that the muscles of the malefactor retained their irritability and power of contraction under the galvanic stimulus for seven hours and a half after the execution. The credit of this, which was due entirely, as my experiments have since explained, to the cold to which the dead body was exposed, was given to the galvanism; here was a second error. The greatest error was conveyed in an inference drawn, and I think naturally drawn, by Aldini, at that time, that the "application of galvanism gives new energy" to the muscles, and therefore that galvanism ought to have first place in the practice of resuscitation. "The well-known method," he says, "of injecting atmospheric air (artificial respiration) ought not to be neglected; but here, likewise, in order that the lungs may be prepared for its reception, it would be proper previously to use galvanism, to excite the muscular action, and to assist the whole animal system to resume its vital functions."

It was all but impossible that teaching such as this, backed as it was by experiment so remarkable, should fail to exert an influence on the practice of medicine in the treatment of suspended animation. It did, in fact, exert the most potent influence. It threw artificial respiration, which had been projected by Hooke, from experiment on animals, and which had been strongly urged by Fothergill and John Hunter, into the shade, and it gave to galvanism for nearly half a century the first place as the means, not simply for calling into motion the remaining energy of the dying muscles, but, as Aldini imagined, for "giving new energy" to the muscles. From the date of that theory, the battery, and after it was discovered, the electro-magnetic machine became the instruments of instruments for resuscitation.

Thirty years ago, when I was commencing my medical career, the application of the galvanic battery in cases of sudden death from drowning, from suffocation, and from other similar forms of sudden accident, was still the approved practice. The mode of operation was to place one pole of the battery at the nape of the neck, and the other pole below the diaphragm, and by passing shocks through the inclosed parts, to excite the muscles to contraction, so as to restore the movements of respiration. The effect was for a little time very startling; it seemed as if the natural function were called again into play; but in the end the motion excited became feebler and feebler; at last the stimulus failed, and the patient was declared to be dead. I recall many instances of this kind. I know of one instance of suspended human life from accidental suffocation, in which, when the natural breathing was just becoming restored by artificial inflation of the chest, the arrival of a battery and the application of it to expedite recovery was followed by complete cessation of all motion in response to the stimulus, and by absolute death. I know of another instance in which a needle from one pole of the battery was carried down to the heart, under the hope of exciting motion from the centre of the circulation, but, as it was said, "without avail."

In this position the method of resuscitation by means of galvanism stood until my experiments on animals recently dead from anæsthesia commenced. In experimenting with the galvanic current I was desirous of making it more precise in action, my original idea being that the constant failure of it as a means of recovery was due, not to fault in principle, but to some mistake of detail. With the research in this direction came the observation, altogether unexpected, that galvanism, even when it is made to reproduce the natural movements of respiration with such precision that they tally completely with the natural respiratory acts of the animal as those were counted and measured while the animal was in health, not only fails to restore the natural respiration in the majority of cases, but in the majority of cases destroys the respiratory power altogether. In brief, the experiments showed that the theory of Aldini, that galvanism "gives new energy" to the muscles was wrong, while the fact came out that the effect of the galvanism is only to whip into silence the muscles that are already well-nigh dead. This, which was found true in respect to the muscles concerned in respiration, was found to be equally true in respect to the heart.

The correction in matter of principle deduced, the comparison followed between artificial respiration carried out with a perfect instrument and the effect of galvanism, in the same forms and modes of death. Therewith followed the result that in extreme states where recovery is nevertheless all but certain by the process of artificial respiration supplied from the hand of the operator, death is all but certain from the application of the galvanic stimulus. The lesson taught by experiment was thus doubly valuable; it exposed the failure of a deceptive and fatal agency for means of restoration; it prompted the improvement of rational and successful means of restoration.

As the experiment with galvanism on the failing muscles of the lower animal opened my eyes to read the real facts, the reason came vividly enough before me, why in the human subject I had seen, with pain beyond measure or expression, the vigorously stirred muscular mechanisms sink under galvanic stimulation into irrevocable rest. Then I could point out and correct the error. In the absence of the experiment, the correction had been impossible. No man on a mere speculation would have dared to withhold from a dying patient the application of galvanic stimulation, until the danger of the practice was proved by experimental science. Yet how solemn is the issue let one example tell! Before the experiments I have related were performed and the new order of facts were elicited by them, I should—in the case of that child, whose history was told in my last communication, and who recovered by means of artificial respiration when the natural respiration had ceased and all the signs of death were developed—have tried, from the practice I then knew, to excite the respiratory power by galvanism, and should have believed, whatever had been the result, that the practice was, under the circumstances, the best that could have been employed. Now I know that the galvanic current would have killed the child outright, as surely as I know that the artificial respiration raised him back into life.

Aldini reports that after the observations on the malefactor, Forster, were concluded, Mr. Keate, the Master of the College of Surgeons, proposed to make comparative experiments on animals. If this had been done at that time and the relative merits of artificial respiration supplied by the power of the operator, and of artificial respiration excited by galvanism from the muscles of the affected subject had been compared, the original error of Aldini that the galvanic current "gives new energy" would at once have been detected, and it would have been seen that the current does no more than disperse the flickering power which the dying muscles retain. As far as I

can ascertain no such comparison was instituted, and so, for nearly half a century, a practice prevailed which must have been constantly taking away the last chances of human life, while a truly saving practice,—artificial respiration,—remained without an improvement from the time of John Hunter, in last century, to that of Marshall Hall, who, in our own days, gave it new and prominent importance.

A dozen painless and carefully-conducted experiments made on inferior animals which were exposed at any moment to be knocked on the head for food, to be killed or mortally maimed with shot, or to be hunted to death in the field or warren, would have taught, in 1803, that the passage of a galvanic current through the muscles of a body recently dead confers on those muscles no new energy; that the current in its passage only excites temporary contraction; that the force of contraction resident in the muscles themselves is but educed by the excitation, and that to strike the life out of the muscles by the galvanic shock without feeding the force, expended by contraction, from the centre of the body is a fatal principle of practice. The experiments unfortunately were not performed, and the error, therefore, fatal as it was, continued without question, until my own unexpected observations revealed it in the light of an error and made it so self-evident that the illustration through which it may best be explained, admitted of being treated, by one who was wise after the event, as a subject for jest.

"Vidi ego, naufragium qui riserat, æquore mergi."

I will not copy the comment of the poet: far more congenial to me were it to save the endangered life.

It is from experiences such as I have given above, and in many instances, that the necessity for experimentation on the lower animals forces itself on the minds of the members of the medical profession, and especially on the minds of those who are most earnest to remove fatal errors of practice and to devise saving methods. If it were only kept steadily in view that we medical men are always dealing with fatal accidents and fatal diseases; if it were only kept steadily in view that we are always asking ourselves—Is this we are doing for the best? Or, as new light dawns on us:—May this we are doing be for the worst rather than for the best, and may the old practices taught to us have rested on a false foundation? If these things were thought of, then our position would be better understood and our actions more correctly appreciated. I believe those who are most severe upon us would be most considerate under this discipline of reason if they would give it trial, and that the very impulses of kindness, I will even say of tenderness, that lead many to oppose experimental inquiry would actually make them experimentalists if they could once realise the highest responsibilities that devolve on the medical scholar. Nay, I am not without hope that my jesting critic himself, if he ever had to stand, as we physicians have to stand, over the body of one of his fellow men, who, in the midst of health had just passed into doubtful death: if this critic, I say, had to stand there wondering what he should do to recal the life, uncertain whether what he was about to do were for the best or the worst; he, I think, would lay aside *Gil Blas*, would be humanely tempted, to risk the sacrifice of the life of a lower for that of the higher animal, and would transfer the rabbit he had provided for his dinner, to the experiment room instead of the kitchen.

BENJAMIN W. RICHARDSON

(*To be continued.*)

OUR ASTRONOMICAL COLUMN

HUTH'S "MOVING STAR" of 1801–2.—At the beginning of the present century, when, although Bode and some few others had been looking forward to such a discovery, astronomers generally were startled by Piazzi's accidental detection of the small planet Ceres, we read of observations of more than one so-called "moving star," which, after progressing slowly for a short interval, finally disappeared. The most singular narrative refers to an object said to have been remarked by Hofrath Huth, at Frankfort-on-the-Oder, on the night from December 2 to 3, 1801, particulars of which were communicated to Bode in several letters during the ensuing five weeks. If the observations are *bonâ fide*, there is yet a mystery attaching to the object to which they relate. Huth was one of the three independent discoverers of the periodical comet now known as Encke's, on October 20, 1805, Pons and Bouvard sharing with him an almost simultaneous discovery, and he did other astronomical work. Writing to Bode on December 5, he says: "In the night from the 2nd to the 3rd of this month, I saw with my 2½-feet Dollond, in a triangle with θ and δ Leonis to the south-west, *a star with faint reddish light, round, and admitting of being magnified.* I could not discern any trace of it with the naked eye; it had three small stars in its neighbourhood." He writes again on the 15th, that unfavourable weather had allowed of his observing the object only on three occasions, which appear to be on the early mornings of the 3rd, 13th and 14th, and he concludes from his observations that it had a slow retrograde motion to the south-west. From the 13th to the 14th, by eye-estimate, it had retrograded 4′ of arc, and from the 3rd to the 13th at most 30′. He forwarded to Bode at this time a diagram of the neighbouring telescopic stars. On December 21 he writes again that he had only succeeded in observing his moving star on one additional night, that of December 19–20, when he found it "near four stars apparently situate to the westward, about half a diameter of the full moon below a smaller one." Its path appeared directed towards i Leonis and towards the ecliptic. He adds: "Of the motion of this planet-like star I can now no longer doubt, since I have observed a difference of $\frac{8}{9}$° nearly, between its positions on the 3rd and 20th." In a fourth letter, dated 1802, January 12, he informs Bode that he had seen the star on two later nights, those of the 1st and 2nd of the same month from 11h. to 14h., with many telescopic stars in its vicinity, of which he enclosed a diagram, by eye-estimate only, with the path of the object.

He mentions that on January 1 the star was even smaller than one of the satellites of Jupiter, and on the following night he had difficulty in perceiving it in close proximity to a star towards which it was moving. On the 5th he could discern only now and then, to the right of the star, on the left of which it was situated on the 1st and 2nd of January, and at a very small distance from it, a glimmer, but the star's former place on the left was vacant. He concludes that the object must have been receding from the earth, and might perhaps have been more distinct and larger before December 3. On the night of January 6 there was no trace of it. He closes this final letter by saying that he would have gladly learned that some other astronomer had observed this star and confirmed its motion, and expressing his regret that Bode had not succeeded in finding it. On the latter point Bode remarks that the weather during December had been but very rarely favourable for observation, and in the few moments that the sky was clear he had occupied himself with his "Seeker" and Dollond, partly in giving attention to the neighbourhood of Huth's star, and partly to the region in which Ceres was expected to be recovered on her second appearance. He also remarks on the imperfect manner in which the star's positions had been communicated to him, but concludes that "without doubt it was a distant comet," and its great distance caused it to appear without nebulosity. He supposes it on December 3 to have been in longitude 156° 20′, with latitude 10° 40′ north, and on January 2 in 154° 20′, with latitude 8° 50′. Huth's rough diagrams are reproduced in the *Berliner Jahrbuch*, 1805,

but they are on a very small scale, and no two persons are likely, perhaps, to agree as to the inferences to be drawn from them. We may remark, however, that the arc of great circle between Bode's extreme positions exceeds the length of the path, as described in Huth's letters. The following places result from an examination of the figures with the particular view to identify several of the telescopic stars entered in the larger diagram :—

1801, Dec. 3.	Longitude ...	157°0	Latitude	+	10°5
,, ,, 14.	,, ...	156·7	,, ...	+	9·9
1802, Jan. 1.	,, ...	156·2	,, ...	+	9·1

Calculations founded upon the deductions from Huth's diagram lead to no satisfactory, indeed no probable, results. The ordinary formulæ fail, but the distance of such an object could hardly have been great.

With regard to the *bona fides* of Huth's observations, it is worthy of remark that he wrote several letters to Bode, while according to his own showing, observations would have been very practicable, but for the unusual prevalence of clouded skies; while there is no doubt of the looseness with which he gave its positions.

Next week we shall refer to a similar astronomical puzzle, or myth, as perhaps some readers may be disposed to consider it.

VENUS IN INFERIOR CONJUNCTION.—Mr. J. Birmingham, Millbrook, Tuam, writes:—"In a careful measurement of Venus at the late inferior conjunction, I found proportionally that the full diameter was no more than 200, while a perpendicular from centre of line between cusps to the limb was from 145 to 150."

THE AUGUST METEORS.—The earth arrives at the descending node of the third comet of 1862 in the track of which the August meteors are supposed to circulate, about midnight, on the 9th inst. The comet itself is distant from the earth 27·8 times the distance of the earth from the sun, requiring yet some forty-seven years before the aphelion point will be reached, and it once more begins to approach these parts of the system. Though it will soon attain a distance from the sun equal to the mean distance of Neptune, its heliocentric latitude is so large, there cannot be any near approach to the planet. The ascending node falls not far from midway between the orbits of Saturn and Uranus, while as is well known at the opposite node, its path almost meets the track of the earth, less than two distances of the moon separating them.

THE KEW GARDENS REPORT

DR. HOOKER'S report on the celebrated gardens under his direction contains this year some facts that will be noted as starting-points in the history of scientific progress at Kew. Thus at the outset we are reminded that a sum of money was included by the Government in the estimate of last year for the purpose of erecting a new building for the herbarium in which will be deposited not only the unrivalled collections of dried plants, but also the valuable library, MSS., and collection of drawings of plants. The great importance of a fire-proof building in which to deposit these valuable treasures, cannot be over-estimated. The old house once occupied by the late King of Hanover, in which the herbarium is now and has been contained for nearly a quarter of a century, has become literally crammed; therefore, both on the score of safety and convenience, the new building which has been commenced since Dr. Hooker wrote will be welcomed by botanists of all nationalities.

Another point in the future history of the Gardens is the erection of a laboratory. Dr. Hooker points out that one of the recommendations of the Commission on Scientific Instruction and the Advancement of Science was, "That opportunities for the pursuit of investigation in physiological botany should be afforded at the Royal Gardens at Kew." To carry this out, T. J. Phillips Jodrell, Esq., M.A., generously placed the sum of 1,500*l.* at the disposal of the authorities, out of which the building has been erected, and will be fitted with apparatus for chemical, physiological, and microscopical work. The design for this building, in which we anticipate a great deal of interesting work will be conducted, is exhibited in the Loan Collection at South Kensington. It is pleasing also to note that "the lessons given to the young gardeners in the evening, in chemistry, meteorology, structural and economic botany, and upon which the attendance is voluntary, continue to give satisfactory results." These lessons, with demonstrations from such rich collections as those of Kew, cannot fail to impart a sound knowledge on those subjects immediately connected with botany, and to prepare the *employés* for important posts in India and the Colonies. Many plants of botanical interest, as well as of economic value, have flowered in the Gardens during the past year for the first time in this country, and have been figured for the most part in the *Botanical Magazine*. With regard to the Blue Gum (*Eucalyptus globulus*), about which so much has recently been written, Dr. Hooker points out that the plant having been so largely distributed and planted, will probably prove to be useful in another way—that of a timber tree, in countries not too hot for its growth. "On the Neilgherries, where Australian trees have been largely introduced, one of the most valuable, the *Acacia Melanoxylon*, proves to be all but valueless, owing to the ravages of various Loranthaceous parasites. The *Eucalyptus globulus* is, however, reported by Dr. Bidie to entirely escape their attacks. He attributes this immunity to the 'deciduous bark, the seeds' (of the parasite) 'thereby being dislodged before they can germinate and gain a hold.'" Liberian coffee, which is of a more robust habit, and produces larger seeds than the *Coffea arabica*, has been distributed with uniform success to most of the coffee-growing countries, foreign or colonial, foremost among them being Bahamas, Bangalore, Barbadoes, Bermuda, Calcutta, Ceylon, Dominica, Jamaica, Java, Madras, Mauritius, Montserrat, Natal, New Grenada, and Rio de Janeiro.

The introduction into India of the South American rubber-producing plants has occupied, and is still occupying, considerable attention. The successful acclimatisation of the Para rubber-tree (*Hevea brasiliensis*), as well as of the Central American plant (*Castilloa elastica*), is a matter of great importance, affecting as it does our future supplies of this invaluable substance. Of the peculiar and interesting plant, *Pringlea antiscorbutica*, or Kerguelen's Land cabbage, Dr. Hooker announces the receipt of seeds both from the *Challenger* and Transit of Venus expeditions, although, however a number of fine young plants were raised, they have nearly all since perished, a similar fate having befallen those at the Botanic Gardens of Paris, Cape-town, and Edinburgh, showing that the plant is very intolerant of warmth.

In the Museums where the collections are constantly increasing, one new feature is specially noticed, that of the separate collection illustrating vegetable teratology and pathology. This collection has rapidly increased since its formation two years since, and will, no doubt, in course of time, prove valuable to students in these interesting branches of botanical science, the more so as no public collection has hitherto existed of this kind, the materials consequently being scattered far and wide.

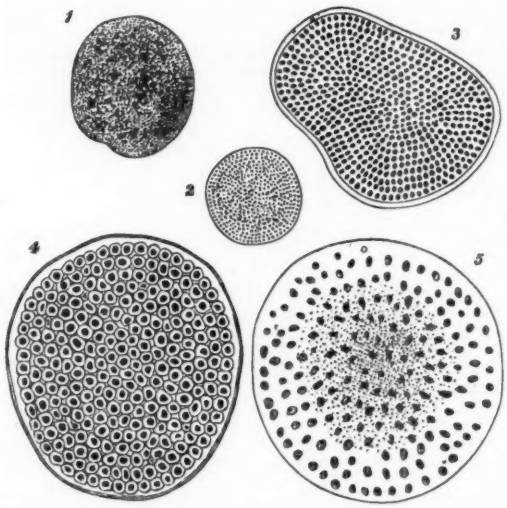
The herbarium has been considerably enriched during the past year, notably by the collections of the late John Stuart Mill, who, besides his other achievements was a diligent collector, and a good botanist; also from other private collections, as well as those of the *Challenger* and Transit of Venus expeditions.

ON THE CLASSIFICATION OF THE VEGETABLE KINGDOM[1]

I.

CLASSIFICATION is a natural propensity of the human mind. If our attention finds itself directed to a large number of objects, about which we desire to inform ourselves, a desire to economise our labour, or even render it possible, at once leads us to endeavour to throw the assemblage into subordinate groups. The result, and indeed end, of this process is to enable us to frame general statements about these groups which cover all the things comprised within them. In the case of a naturalist it is desirable that the groups should be so constituted as to admit of as many general statements as possible being made with regard to them; and in proportion as our classification allows us to do this successfully, we say it is a natural one—one conformable to the order of nature—and such as nature herself would indicate if the task were assigned to her rather than undertaken by us.

The question, however, immediately arises, What is the cause which brings about this possession of common



FIGS. 1–5.—Development of colonies of *Bacterium rubescens* after Lankester ("Quart. Journ. Micr. Soc.," 1876, Plate III).

characters by each member of a group of organisms, and renders their natural classification possible? We are now able to answer with a very high degree of probability of the explanation being the true one, "that propinquity of descent—the only known cause of the similarity of organic beings—is the bond, hidden as it is by various degrees of modification, which is partially revealed to us by our classifications."[2]

The earliest attempts at classification seized upon the most striking superficial distinctions. When Solomon "spake of trees from the cedar tree that is in Lebanon, even unto the hyssop that springeth out of the wall," it is quite evident that mere *size* was the point of comparison which aided the process of passing them under review. And till the time of Ray and the beginning of the eighteenth century the classification of plants into trees, shrubs, under-shrubs, and herbs held its ground, though nothing is now better understood than that size, which is a mere matter of habit and mode of growth, is no clue at all to the real affinities of plants. It is easy to see in point of fact when we have once grasped the principle of descent as the cause of resemblances, that those characters which are most valuable for classificatory purposes, are generally those which are least prominent. From age to age organisms may vary in response to the changes of the external conditions to which they are exposed. Nevertheless, underlying the most manifold modifications, some apparently insignificant detail of structure or development will be handed on unchanged, because it has never happened to conflict with the stress of existence, and such a detail will reveal the story of relationship which the comparison of more striking, but really less essential (because *adaptive*) external modifications would perhaps completely obscure.

Thus, comparing the two great departments of activity, into which the life of plants is divisible—nutrition, *i.e.*, all that concerns the growth or multiplication of the *same* individual, and reproduction, *i.e.*, all that concerns the production of a *new* individual, while characters drawn from nutritive structures (such as branching and texture of stems, form of leaves, &c.), have proved of little value, those taken from reproductive structures have proved of the highest importance for purposes of classification. And the reason is that a plant must live before it can reproduce. The stress of competition is harder on the nutritive side of its life than on the reproductive. Habit of growth, which is the expression of the plant's attempt to adapt itself to the conditions of existence prescribed to it, must vary as the conditions vary;

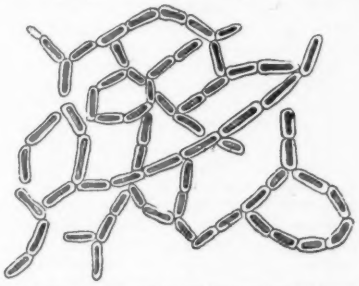


FIG. 6.—Zoogloea stage of *Bacterium rubescens* after Lankester ("Quart. Journ. Micr. Soc.," 1873, Plate XXIII.).

but the development of ovules and homologous organs comes when the battle of life, so to speak, is won. Their details of structure, and the development of the embryo-plants which proceed from them are, at any rate, in a great measure relieved from the necessity of undergoing adaptive changes. They undergo, no doubt, progressive modifications, but these are comparatively slow and are perhaps brought about in part by the correlation of growth, which causes a changing part of an organism to effect alterations in other parts which are not at first implicated in or directly benefited by the original modification, and yet cannot help participating in it because the organism must alter more or less as a whole.

Thus, then, as amongst human beings, whether we consider the family or the race, similitude or family likeness implies blood-relationship or community of descent; in all organisms resemblances in structure which are constant in large groups or vary very slowly, imply origin from a common ancestor. The real problem of classification is nothing less than to group organisms as we should see them grouped if we could inspect the mighty family trees of the plant or animal worlds. This mode of regarding the facts of natural history is termed phylogeny.

In undertaking the actual task of classification, we proceed on the assumption that as in a tree the twigs which form the growth of any one year belong to branches of all ages—from the very earliest to the very youngest—the

[1] Notes of four lectures delivered at the Royal Institution during February and March.

[2] Darwin, "Origin of Species," 4th Ed. p. 489.

living constituents of the vegetable kingdom represent, more or less modified, various successive grades of development which plants have passed through. Some of the branches of the family tree have now no living representatives, and as to these we must seek for such evidence as palæontology affords us. To trace out the family tree in all its details must obviously be always a matter of extreme difficulty, and may never be completely possible. Our present information does not extend to much more than

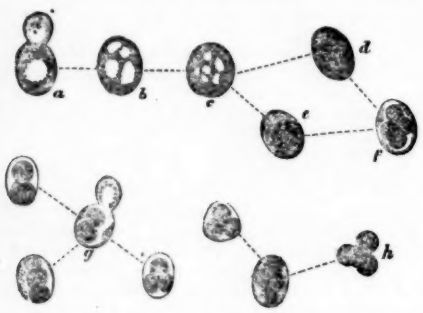


FIG. 7.—Successive stages in development of spores of yeast (after Reess).

a knowledge of the closely-packed exterior formed by the ultimate twigs. We cannot see very far how these pursue their course, nor get more than an approximate notion of the way in which the main branches are given off. Clearly, however, we may assume that organisms have in the main proceeded from simple and generalised forms to those which are specialised and complex. The simpler existing plants will therefore be the representatives of the oldest forms of all.

As long ago as 1836 Endlicher divided the vegetable kingdom into Thallophyta (leafless plants) and Cormophyta (leafy plants). The one exhibits the presence, and the other, if we may say so, the absence of the contrast of leaf and stem. Leafless plants are clearly the simpler, and come nearer, therefore, the base of the family tree.

Now Thallophyta have long been held to fall into two great groups—*Algæ* (tangles), which, speaking generally, are independent of organic nutriment, contain chlorophyll, and build up the materials of their tissues from inorganic materials; *Fungi* (thread-plants), on the other hand, are wholly dependent on other organisms, which they feed on, either living or in decay. Each series ranges from the very simplest forms which it is possible to conceive endowed with life, up to others which display a very complicated structure. Nevertheless there is a remarkable structural parallelism between them, and it

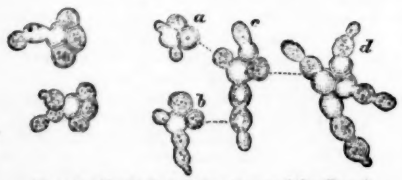


FIG. 8.—Germination of yeast-spores (after Reess).

seems probable that the Fungi do not possess a continuous line of descent of their own, but that they are an assemblage of reduced or degraded forms which have abandoned the business of food-manufacture, and appropriate their nutriment more or less ready made, and which correspond to different points in the line of descent of Algæ. *Thallophyta*, therefore, disregarding the cross division into Algæ and Fungi may be classified after Sachs,[1] and mainly according to their reproductive processes into four classes:—1. Protophyta; 2. Zygosporeæ; 3. Oosporeæ; 4. Carposporeæ.

PROTOPHYTA consist of excessively minute plants only visible to the naked eye when aggregated together in considerable masses. They consist of minute particles of protoplasm often no larger than a human red blood-corpuscle or much smaller, which are usually invested with a covering of cellulose, sometimes, however, very hard to distinguish. The protoplasm is homogeneous and without a denser portion or nucleus, but may contain minute particles, and even watery globules. It is either quite colourless or contains chlorophyll more or less masked with other colouring matters. Multiplication is effected by the fission or bi-partition of the protoplasm of one individual or cell. This frequently takes place in a single direction only, so that the new individuals more or less adhere together in a linear series. The cellulose investment or cell-wall is apt to pass by the absorption of water into a gelatinous condition, which may even form a kind of matrix in which the individual cells seem to be imbedded. Two groups deserve especial attention, *Schizomycetes* and *Saccharomycetes*. Both are destitute of chlorophyll, and so are dependent for their nutriment on materials elaborated by other organisms. In obtaining what they want they set up incidental chemical changes and decompositions. Thus Bacteria bring about *putrefaction* in fluids containing nitrogenous matters, and yeast produces *fermentation* in saccharine solutions.

FIG. 9.—Formation of spores of *Mycoderma vini* (after Cienkowski).

When any fluid capable of undergoing putrefaction is exposed to the air at a temperature of about 30° C., it speedily loses its clearness and becomes turbid and milky. This is usually due in the case of vegetable infusions to the presence of immense numbers of a minute organism known as *Bacterium Termo*. Other forms are, however, met with, and according to the nature of the fluid, one or other seems to get the upper hand and predominate. They vary in shape from a mere rounded speck ($\frac{1}{3000}$ in. in diameter) to elongated rod-like bodies sometimes rolled into a short spiral. The rod-like forms exhibit free movements which in the larger are obviously due to the presence of a cilium at each extremity, and are probably so in all.

The life history of the Bacteria is still imperfectly known. One striking kind has been studied from macerating pans by Prof. Lankester. It exhibits a great variety of forms, but all are tinged with a peculiar purple pigment, and it seems probable, therefore, that they all belong to the same species, and that the different phases are due to diversities in the condition of development or culture. This, if true, would apply to other series of forms which are colourless or tinged with other pigments. In one condition the Bacterium is in a kind of resting condition (Fig. 1), and is a mere microscopic spherule of protoplasm. This gradually granulates (Fig. 2),

[1] Lehrbuch der Botanik, 4th ed., pp. 248, 249.

and the protoplasm aggregating about the new centres, the spherule by successive stages (Figs. 3-5) reaches a condition in which it forms an assemblage of individuals held together by their gelatinous investments. These aggregates break up, and the individuals disperse. Their subsequent degree of elongation varies, but a biscuit-shaped form is a common one. Like other Bacteria they divide repeatedly, and ultimately accumulate in masses at the bottom of the fluid or on the surface in reticulated arrangements (Fig. 6), which are sufficiently permanent from the adhesion of their gelatinised coats (Zoogloea stage). The parallelism which these processes possess with those of higher forms of Algæ will be alluded to hereafter. The whole of the *Schizomycetes* or *Bacteria* appear to be reduced representatives of the *Oscillatorieæ*, a group of Protophyta which possess the chlorophyll which Schizomycetes have lost. They have, in addition, a peculiar bluish tint, and this may be recognised in Bacterium Termo.

The *Saccharomycetes* must be dismissed very briefly. Yeast (*Saccharomycetes cerevisiæ*), consisting of pale spherical cells about $\frac{1}{1000}$ in. in diameter, is the type of the group, and multiplies, not like Bacteria, by fission, but by the budding out of new individuals from different points of the parent cell, these often forming a short chain by repetition of the process, but being subsequently detached by constriction. Under conditions unfavourable to growth, as when the yeast is cultivated on slabs of moist plaster of Paris, beside growth by external extension, there is also a process of internal segmentation of the protoplasm (first observed by Reess). These two modes of reproduction may be compared to the two which take place in *Bacterium rubescens*. The latter of these in the case of yeast results (Fig. 7) in the massing of the protoplasm into four spores which are finally set free by the disruption of the parent cell-wall. They germinate when put into a favourable fluid, and reproduce chains (Fig. 8).

The ferment of wine (*Mycoderma vini*), besides other points of difference, produces cylindrical instead of spherical cells. These also give rise to spores (Fig 9) by internal segmentation. W. T. THISELTON DYER

(*To be continued.*)

METEOROLOGY IN JAPAN[1]

EACH of the numbers of Mr. McVean's publication gives the tri-daily observations of the various meteorological elements for five days, beginning with December 2, 1875, with the means and extremes for each of the five-day periods. The observations and reductions of each sheet have been made with great fulness and discrimination, and we hope Mr. McVean will soon be in a position to extend his system of observation to more places than Tokei, so as to give the data for the determination of the meteorology of Japan, which, from its relations to the continent of Asia and ocean currents, presents many points of great and peculiar interest.

The data discussed in Staff-Commander Tizard's "Contribution to the Meteorology of Japan" have not been obtained through the observing staff of the *Challenger*, but from records lent by the Superintendent of Japanese Lighthouses and Buoys. They consist of observations of the barometer, thermometer, rain-gauge, wind and weather, as made at twelve lighthouses, two lightships, and at Yedo, the monthly averages of which are represented on four diagrams. The barometric and wind results are besides shown, by isobars and arrows, on twelve small maps for the different months of the year. The Meteorological Committee publish, as an appendix to the paper, six closely-printed pages of tabular matter, giving the results of observations made in the seas of China and Japan, deduced from registers kept for the Meteorological Office.

The winds are, perhaps, the most valuable part of the paper, as showing the variations of wind with season at different places on the coast; they are, moreover, in general accordance with what was previously known of the meteorology of Japan. The rain results are interesting, but they would have been more valuable if the position of the gauges had been stated. From the necessarily faulty position of the thermometers, viz., "in the gallery outside the lantern in the air and shade," the averages of temperatures can only be regarded as roughly approximate. Thus it is difficult to see how, if the mean temperature of July be 76°·3 at Yedo, it is 86°·6 at Nagasaki.

The barometrical results can be regarded with nothing but astonishment. In the winter months the mean pressure decreases from the isobar of 30·30 inches, which skirts the south coast to the isobar of 30·10 inches, which passes through the centre of Japan, the lie of the isobars being from about W.S.W. to E.N.E. With this distribution of pressure, all meteorological observation would lead us to expect the prevailing winter winds of Japan to be south-westerly. The observations, on the contrary, show the prevailing winds to be northerly, in other words, they are in direct opposition to Buys Ballot's law of the winds. In summer the results are still more extraordinary. In these warm months pressure increases from the sea-coast inland. From Yedo westward to Sikok, a distance of about 350 miles, the lie of the isobars is from about W.S.W. to E.N.E., the highest isobar being the most northern. From this disposition of the isobars the laws established by meteorology would lead us to expect northerly winds. Observation, however, shows on this part of Japan the prevailing summer winds to be southerly. In this season, also, Buys Ballot's law of the winds is violated.

The discussion of this paper, therefore, teaches us that if we stand with our back to the wind in Japan, the low barometer is on our right, whilst everywhere else in the northern hemisphere from which we have observations, the low barometer is to our left.

But this is not all. In August the mean pressure at 32° and sea-level at Sagami (lat. N. 35°·8, long. E. 139°·41) is 29·371 inches, and in the same month at Yedo (lat. N. 35°·41, long. E. 139°·47) the mean pressure is 29·931 inches. These places, which are about thirty-three miles apart, have a difference in their mean atmospheric pressure for August of 0·560 inch, thus giving *a gradient in the mean pressure* in August of an inch in sixty miles. So far as we are aware, the steepest gradient yet noted at any time in this country was an inch in seventy-two miles during the Edinburgh hurricane of January 24, 1868—a gradient accompanied with a wind which threw down solid masonry, and horses as if they had been "jointless pieces of wood" (*Jour. Scot. Met. Soc.*, vol. ii. p. 177). Japan, however, presents us, in the above results, with an *average* summer gradient which, while it exceeds the *maximum* gradient attained during the Edinburgh hurricane, is accompanied only with delightful breezes as the prevailing summer winds of its coasts.

Most meteorologists will perhaps be inclined with us to let their notions regarding aërial movements remain undisturbed till it appears whether these results may not have sprung from extraordinarily constructed or disordered instruments, or even, it may be, clever manipulations.

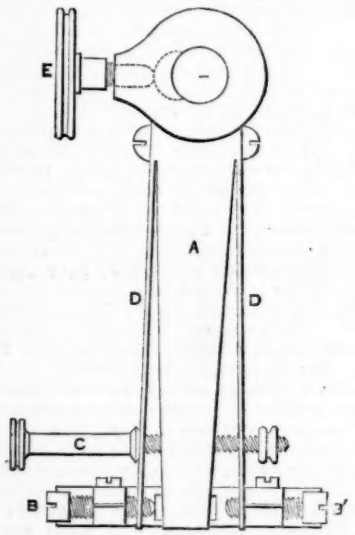
While allowing that the author of the paper, who does not appear to be familiar with what has been done in meteorology in recent years, has discussed the materials before him with some ability, we can only express our regret that the Meteorological Committee have authorised the publication of the paper in its present shape, and included

[1] Observations taken at the Imperial Meteorological Observatory, Tokei, Japan, under the direction of C. A. McVean, Surveyor-in-Chief, No. 1 to 23 —"Contribution to the Meteorology of Japan," by Staff-Commander T. H. Tizard, H.M.S. *Challenger*. Published by the authority of the Meteorological Committee, Official No. 28.

it among their twenty-eight publications marked "OFFICIAL;" and the more so inasmuch as its teaching directly tends to overturn the rules which guide seamen in storms and hurricanes, as well as the first principles of atmospheric physics.

GENTILLI'S TACHEOMETER

AMONG the instruments exhibited in the South Kensington Loan Collection is one likely to prove of great use in survey-making; it is the invention of M. Gentilli, an Austrian engineer, and its main purpose is to accomplish rapid surveys (hence its name) of difficult country. Not only does it survey the ground, but it gives the height and distance of every point surveyed. The instrument itself differs little from an ordinary surveying telescope. A vertical lever, A, is attached to the axis of the telescope by means of a screw, C (in figure); this lever moves the axis through a given angle, which can be exactly adjusted by means of the two stops, B B′, opposite the free end of the lever. The points to be surveyed are marked by a surveying staff, on which are shown in a manner to be visible at a great distance, very minute divisions of a foot. The telescope is pointed to this distant staff of which it measures: (*a*) the horizontal angle of position, (*b*) the vertical angle of elevation, (*c*) the distance of the instrument from the staff. It is the accuracy with which this last



datum can be read that is accomplished by the peculiar mechanism of Gentilli's instrument. As an example: Suppose the staff marked with divisions, to have a scale of 12 feet, on which feet, inches, and eighths of an inch are shown. The telescope is directed to the top of the scale, of which it gives the horizontal and the vertical angle. It is next directed downwards by the screw to a fixed stop, and there it reads on the staff, say 10 feet 5 inches below the former reading; that distance on the staff is 1,000 eighths of an inch, and tells us that the staff is 2,000 yards off. In short, the greater the angle through which the telescope is moved, the greater the distance and *vice versâ*, Gentilli's telescope reading the distance and giving it exactly as read, without calculation of any kind. The mechanism is so precise that the telescope can be moved through any given angle and restored to its original position with almost perfect accuracy. Practice has shown that the distances so measured by a small instrument of only 40 magnifying power are correct to within $\frac{1}{2000}$ part. The instrument seems likely to be of the greatest use both to ordinary surveyors and to those who have to carry on extensive topographical operations.

THE RADIOMETER IN FRANCE

ALTHOUGH Mr. Crookes's apparatus was described in a few French papers at the end of last year, the novelty of the phenomenon has prevented physicists from paying due attention to it till within the last three months. But now the subject has been brought before the Institute and a number of experiments have been made or are being contemplated which are deserving of notice.

The first apparatus in Paris were procured from London, and also from Germany by Geissler; but now they are exported from Paris. There are in Paris not less than three makers—M. Gaeffe, M. Alvergniat, and M. Saleron—who are daily selling the apparatus, so that the instrument will soon become common in all laboratories in spite of the price, which is about 25 francs.

M. Fizeau, the well-known physicist, has stepped forward to defend the theory of air-dilatation. The most formidable objection was proposed by M. Ledieu before the Institute. This mathematician insists upon the great fact that in the air at the ordinary pressure the blackened plate is attracted instead of being repelled. He says that there is a decided opposition between these two phenomena, and that at a certain pressure the radiometer cannot move at all. I do not know whether the experiment has been actually tried. The best plan for investigating the question is to construct radiometers in different gases, carbonic acid and hydrogen, which I intend to do. If the rotation is produced merely by dilatation of the residual gas the motion must be quicker in hydrogen and slower in carbonic acid, owing to the difference of conducting power and mobility. But even then it remains to account for the inversion of rotation.

Sometimes the radiometer rotates in an opposite direction without any apparent cause operating upon it. In investigating the question I demonstrated very simply that this is because it emits heat. To obtain inverse rotation it is sufficient to leave it for some length of time exposed to the rays of the sun, or to the radiation of a furnace, and to plunge it in a vessel full of cold water. The effect is immediate, the inversion takes place almost instantly; but the real quantity of heat accumulated in plates being very small indeed, the inverse rotation is accelerated for a few seconds, and diminishes at a very rapid rate. In less than half a minute the radiometer stops and direct action of the rays causes it to rotate again in the direct way if the vessel is of glass and transparent. The same experiment can be made in the shade, but it requires more caution, as the inverse action is less powerful, and the light can operate with sufficient force to continue the rotation in the normal direction, in spite of reverse force produced by refrigeration. But even in these cases it is possible to perceive a diminution in the rate of rotation. The radiometer falls to a rate which is smaller than the final one, and suffers a visible augmentation after a temporary diminution in the first instance.

M. Alvergniat exhibited, at a recent sitting of the Société de Physique, a double apparatus to demonstrate that the position of the blackened face determines the direction of rotation. The following experiments can be made with a radiometer with both plates blackened, and illustrate the same fact with greater simplicity if the half of the transparent sphere has been previously blackened.

If the blackened hemisphere is perpendicular to the rays, the radiometer will remain motionless; but in an oblique direction it will rotate to the left or to the right, according to the inclination of the incident rays. The least surplus in the quantity of light or heat received by any influenced surface will rotate the apparatus in the direction of repulsion.

M. Saleron made an experiment suggested by M. Ledieu, and which is a consequence of the fact above mentioned. If the light is received alongside the axis, the radiometer rotates. The velocity of the rotation is not yet in our hands.

The reflection of the light on the glass creates a disturbing force, as it is easy to show by the following experiment, which I made before the Academy of Sciences :—The bulb of an ordinary radiometer being half blackened, the rotation takes place in the same direction, whatever be the position of the blackened hemisphere, but at different rates. With the light falling on the white side, the rotation is reduced to about $\frac{1}{4}$, and about $\frac{3}{4}$ when falling on the blackened side. Both numbers give exactly 1, *i.e.*, the regular number of the translucid sphere. Consequently, I suppose the reduced rotation to be produced by the light reflected on the glass by the blackened surface, which light adds its effects to the light falling directly on the said blackened surface. This theory is in conformity with the well-known fact as stated by Crookes, that light A + light B gives one effect A + B, whatever be the respective situation of the lights on the circumference of a circle whose centre is the radiometer. I have no doubt that, by silvering the blackened hemisphere, which enlarges the reflecting power of the interior, the velocity of either rotation can be enlarged.

These remarks explain facts that, according to the dilatation theory, are a mere impossibility, the rotation in the same direction when a ray of light falls on the black or on the white side. These experiments can be made not only with a white or a black radiometer instead of alternate, but also with entirely transparent bulb, if light is predominant in one direction.

The difficulty in using the radiometer as a photometer is in the velocity of the revolutions. M. Gaiffe constructed for me a radiometer with a graduated screen which was in operation at La Villette Gas Works, and was sent to the lighthouse experimental establishment. Unfortunately that instrument requires a heliostat to send the rays into the aperture. Under that limitation the instrument works well, as the scale of proportion has been very easily established.

That reduction can be tried with a greater simplicity with a differential radiometer with plates differently coloured, the left with blue and the right with green or red. The rotation will be equal to the difference of rotating power, as demonstrated by the radiometer with both sides blackened. I suppose that white-blue + blue-black will give almost exactly the number of white-black, and that the rotating force might be so easily fragmentised. By a graduation all these different radiometers can be compared with each other.

Some of these radiometers are being constructed according to my suggestion by M. Gaiffe, and will be presented to the Academy as soon as the aforesaid theory shall have been demonstrated experimentally.

W. DE FONVIELLE

PROF. STEERE'S EXPEDITION TO THE PHILIPPINES

IT may interest zoologists to know that an American gentleman, Prof. J. B. Steere, of the University of Michigan, has recently returned from an expedition to the Philippine Islands, bringing with him large collections of natural history objects. The birds he has submitted to me, and I am now engaged in preparing a memoir on the collection, which seems to be one of the most important ever made in the Indo-Malayan Islands. In spite of the great difficulties which meet the traveller in the Philippine group, and notwithstanding severe attacks of fever, Dr. Steere exerted himself with great energy, and as he visited many islands in which no previous collection had ever been made, it is not surprising that many novelties occur in the one he has now brought over to England for description.

Leaving Hongkong for Manila, in May, 1874, Dr. Steere crossed the Island of Luzon by way of Mauban and Lucban to the Pacific, passing some time on the mountain of Ma-hay-hay, near the Laguna de Bay. In July he went by steamer to the colony of Puerto Princesa, on the east side of the Island of Palawan, where he stayed a month. From thence he crossed to the Island of Balabac and remained a month, afterwards visiting the south-east corner of the Island of Mindanao, and resting for a month and a half at Zamboanga and the Indian village of Dumalon in the same province. The Island of Basilan, lying between Mindanao and the Sooloo group, was next visited, and here he stayed two weeks, after which he returned to Zamboanga and thence to Manila. In the month of December he again went south, stopping at Ilo Ilo, on the Island of Panay, and visiting the mountains in the interior. After a short stay at the neighbouring Island of Guimaras he crossed over to Negros, journeying on horseback round the north end of the island ; thence in a native boat he traversed the sea to Zebu, which he crossed, till he arrived at the town of the same name, where he took horse again and rode southward, crossing the island once more and passing over the strait to the town of Dumaguete, on the Island of Negros. Dr. Steere then went back to Zebu and crossed to the Island of Bohol ; after passing round part of this island he returned to Zebu and afterwards to Manila, where he visited the Negritos on the north side of the Bay of Manila, leaving finally in April for Singapore.

Full descriptions of the new species will shortly be prepared, but meanwhile I cannot avoid drawing attention to one or two of the most remarkable forms, chief amongst which will be the following :—

Eurylæmus Steerii, Sharpe. Unlike any other member of the *Eurylæmiaæ*, no species of which was previously known to inhabit the group. It has a grey back, white collar round the neck, the head and rump deep purplish, the tail chestnut ; wings black with a yellow bar across the secondaries, white on the innermost ; sides of face and throat black ; rest of under surface white. The male differs in having the under surface purplish red. Hab. Basilan.

Phyllornis palawanensis, Sharpe, apparently different from every other *Phyllornis* by reason of its yellow throat, green under surface, and blue-edged primaries. There are other differences, but the above seems to be a combination of colouring not met with in the other species. Hab. Palawan.

Brachyurus Steerii, Sharpe. Green with a black head ; shoulders and a band across the rump bright cobalt ; tail black ; below verditer blue or light cobalt, the throat white ; centre of the abdomen black ; vent and under tail-coverts crimson. Hab. Dumalon, Mindanao.

It is, however, among the sunbirds that Dr. Steere seems to have discovered the most curious novelties, as will be seen from the following birds :—

Æthopyga magnifica, Sharpe, resembles *Æ. flavostriata*, Wallace, from Celebes, but is larger, with a stronger bill, black belly, and is at once to be told by its black under-wing coverts. Hab. Negros.

Æthopyga Shelleyi, Sharpe, like *Æ. dabrii*, and *Æ. gouldiæ* in appearance, but without the elongated tail, and distinguishable at a glance by the entirely yellow under-surface, streaked on the breast with scarlet ; the throat is yellow, bordered with a double moustachial line of scarlet and steel blue. Hab. Palawan.

Æthopyga pulcherrima, Sharpe, a small species, probably generically distinct. Above olive-green, with a steel blue frontal patch, and streak over the ear-coverts ; wing-coverts, upper tail-coverts, and tail, metallic steel-green ; rump yellow ; wings olive ; under-surface entirely

bright yellow, with a spot of vermilion on the lower throat. Hab. Basilan.

Arachnothera dilutior, Sharpe, resembles *A. longirostris*, but is distinguishable by its brown lores and by the ashy whitish colour of the entire under-surface, only the flanks being slightly washed with sulphur-yellow; pectoral tufts orange-yellow. Hab. Palawan.

Dicæum dorsale, Sharpe. Looking at first sight like *Prionochilus percussus*, Temm. Blue-grey above with a conspicuous dorsal patch of orange-scarlet; underneath orange, paler yellow on the throat and abdomen. Hab. Palawan.

Dicæum hypoleucum, Sharpe, of the same group as *D. retrocinctum*, Gould, but plainer coloured, being entirely black above, and entirely white below (♂). Hab. Basilan.

Dicæum hæmatostictum, Sharpe, also of the same group as the preceding. Black above, white below, the centre of the body bright crimson, with a black band across the fore-neck. Hab. Guimaras.

R. BOWDLER SHARPE

SCIENCE IN GERMANY

(*From a German Correspondent*)

CIENKOWSKY, who several years ago made some exceedingly interesting communications on the low organisms known as Monads (*Archiv für Microscopische Anatomie*, i. 1865), has recently contributed more additional information regarding them and allied organisms (*ibid.*, xii. 1875). To the lowest order of plants belong the Myxomycetes, which, in the complete state, form protoplasmic nets, named plasmodia. Cienkowsky found such plasmodia in fresh water, which fed themselves by suction of algæ; on passage into the resting state, they fell asunder into several cysts, and (what is deserving of special attention), by the release of small portions from their mass, produced amœba, *i.e.*, self-supporting individuals, which creep about by means of pseudopodia, and which have hitherto been regarded as independent animal organisms. As this phenomenon has also been observed in other plasmodia (Brefeld), it is not improbable that very many amœba do not represent independent forms, but belong to the development cycle of other and plant-like forms. *Ciliophrys infusionum*, an organism which stands very near the animals named Actinophrys, is transformed while under the covering glass, into a swarmer (swarmspore), and when several individuals are connected, or one enters on the process of division, there arise as many swarmers as there were parts. Through this formation of swarmers there appears Heliozoa, which group belongs to the Actinophrys, closely related to Monads, or those lowest organisms which have been claimed both by zoologists and botanists as objects belonging to them. Among the Monads, Cienkowsky observes various encystments, divisions, and colony formations; but the most remarkable of such processes is that in *Diplophrys stercorea*, an extremely small cell-like organism with a yellow spot, and pseudopodia at two opposite ends of the body. These little bodies, observed in moist horse-dung, multiply by division, and form by union of pseudopodia, long strings in which separate individuals can glide to and fro. In several of the organisms he examined, Cienkowsky was able to observe the taking up of solid food by suction of algæ. Thus the boundary lines, which it has so long been usual to draw between plant and animal organisms, and between the individual groups of those lowest forms of life, appear more and more illusory, and the supposition is recommended of a common lowest kingdom of organisms, that of Protista (Haeckel), out of which animals and plants have by degrees been differentiated.

The Amphioxus, that remarkable animal which, by its position at the lower end of the series of vertebrates, is become much better known, even among the laity, than most of the other vertebrates, enjoys no less the continual attention of anatomists. Among the various recent works which have had Amphioxus for their subject, one of the most comprehensive is that of Langerhans (*Archiv für Microsc. Anatomie*, xii. 1875), from which I take some generally interesting data. The Amphioxus, it is known, is so indifferent in the fore-end of its body that opinions as to the extent to which it is to be regarded as a head, and what parts of it are to be compared to the characteristic parts of the head in other vertebrates, are still ever at variance with each other. Especially does the fore-end of the central nerve system receive various explanations, and Langerhans has set himself to determine more precisely its anatomical relations. The entire central nerve-system is a regular tube which only at the fore-end is somewhat enlarged. This part, therefore, has been named the brain, but it has been compared now with this, now with that, part of the brain of other vertebrates, according to the determination of the nerve proceeding from it. Now Langerhans shows that from the brain proceeds one pair, and somewhat further back a second pair, of nerves, which are distinguished from all other peripheric nerves, in that some ganglion cells are interposed in their course. They can only, therefore, be denoted as special brain nerves. Further, there is the left side extremity of the brain in front, the point of which is connected with the olfactory cavity, and which, as a hollow prolongation of the brain, can only be compared to a bulbus olfactorius, while the pigment spot referred to as an organ of sight lies also not outside of the brain (Hasse), but in its front wall (W. Müller). The fore-end, accordingly, of the central nerve-system of the Amphioxus, as far as behind the roots of the second nerve pair, is to be compared with the entire brain of other vertebrates, not with separate parts of it. Further, of the two higher organs of sense of the amphioxus, the organ of smell is allied to that of other vertebrates, the organ of sight to that of the Ascidians, whereby the relation between these latter, the Amphioxus, and the vertebrates, is confirmed. As to the significance of the body-cavity of Amphioxus, Langerhans is not yet very clear, and only the history of development can give satisfactory information regarding it. He found, however, that in this cavity lie not only the organs of sex, but also excreting glands, which may be regarded as kidneys; so that the space appears, at least physiologically, as the ventral cavity. Those glands which F. Müller had already observed, occur in peculiar folds of the epithelium of the ventral cavity, so that the excretion takes place directly into this cavity; a structure which is repeated at least in the embryonal organs of excretion of Amphibia (Goette). The sex organs of the Amphioxus are at first quite similar for both sexes, and placed indifferently; they arise from a thick-walled bladder, composed of quite homogeneous cells in the wall of the ventral cavity. At the time of sexual maturity, these indifferent cells are transformed either into semen-forming elements, spermatoblasts, or simply grow into eggs. Langerhans met with both sexual products in the same organ, so that perfect homology of these is established for Amphioxus, as Goette and Semper have previously affirmed it for Amphibians and Selachians; and the hypothesis of hermaphroditism as the original form of the sex organs must be rejected. After demonstrating for some other organs and tissues, the agreement of the amphioxus with other vertebrates, especially with Cyclostoma (and the hitherto doubtful presence of blood-capillaries in the former is confirmed), Langerhans comes to the conclusion that, in opposition to the view advocated by Semper, who disputes the affinity of Amphioxus to the vertebrates, such an affinity appears indubitable, from most of the anatomical relations.

NOTES

A NUMBER of highly interesting excursions has been arranged in connection with the meeting of the French Association at Clermont. One day will be devoted to a visit to the argentiferous lead-mines of Pontgibaud, the lavas of Volvic, the town of Riom. There will be a second excursion to Issoire, "celebrated for its college and its caldrons," wrote Voltaire; there will be a visit to the grottoes of Sonas on the same day. There may also be a third excursion to Thiers, the cutlery and paper manufactures of which are of interest. A last excursion, consisting of a visit to the thermal stations of Mont-Dore, Bourboule, and St. Nectaire, has somewhat tried the ingenuity of the local committee, as it will be difficult to get conveyances enough to carry the members to these somewhat distant points. But no doubt, as we said last week, the great attraction of this meeting will be the inauguration of the observatory on Puy-de-Dôme, which amid many difficulties has been established by M. Alluard. From the elevated summit, 1,480 metres, may be seen the fertile Limagne, the hills of Forez, the peaks of Mont Dore, and all

the chain of the extinct craters of the Dôme Mountains, which run from south to north, having Puy-de-Dôme in the centre.

THE livery of the Musician's Company, with the freedom of the City of London, was appropriately conferred on Sir Henry Cole, at the dinner on Tuesday. In presenting the honour, the Master, Mr. William Chappell, F.S.A., traced Sir Henry's career with deserved appreciation. Sir Henry was educated at Christ's Hospital. His first public service was as assistant-keeper of the Public Records, where he paved the way to the establishment of the General Record Office. A second public service was the energetic assistance rendered by him to the establishment of penny postage. He gained one of the four prizes of 100*l.* offered by the Treasury for suggestions to develop Sir Rowland Hill's plan, and continued his aid to Sir Rowland until his object was fully attained. He had himself accepted the office of Secretary to the Mercantile Committee on Postage, and was thus instrumental in furthering the success of a measure which he had helped to carry. Sir Henry's services to Art and Science in this country are well known to every one. The exhibitions of art manufactures which commenced about the year 1846, at the rooms of the Society of Arts, were projected and organised by Sir Henry Cole. These annual displays were designed to lead to national exhibitions of arts and manufactures every fifth year. The first of this series would have taken place in 1851, but the plan was developed into the great exhibition of that year. Mr. Cole was one of the executive committee of that famous and most successful exhibition, and received the honour of Companionship of the Order of the Bath at its conclusion. In the following year he was invited by the Government, through Earl Granville, to improve the system of the schools of design, and he was thus instrumental in establishing the Science and Art Department, of which he was at first senior secretary, and afterwards inspector-general. To the pecuniary success of the great exhibition in Hyde Park, which sprang out of Sir Henry Cole's projection of one of more limited character, we are, as we showed in a recent article, mainly indebted for the present magnificent establishments at South Kensington. In 1860 Sir Henry was appointed General Superintendent of the South Kensington Museum, and also acted as Secretary of the Science and Art Department, under the Committee of Council on Education. In this capacity we know that he created, or was directly responsible for, the system of Science and Art Schools which by general consent are acknowledged to have done so much good already for the country. In 1873 he retired from office at South Kensington, after fifty years of public service. Sir Henry's services were acknowledged by her Majesty in conferring on him the rank of Knight Commander of the Bath about two years after his retirement. The last honour which has been conferred upon him is most appropriate, as we have said, and assuredly well deserved.

ON Tuesday a deputation from the British Medical Association waited on the Home Secretary for the purpose of laying before him several resolutions recently passed unanimously at a meeting of the medical profession in London. On behalf of the deputation Dr. Hutchinson handed in the following resolutions:—1st. Proposed by Dr. Andrew Clark and seconded by Dr. Pavy, "That this meeting, although fully recognising the improvements in the Bill of Lord Carnarvon, is still strongly of opinion that should it become law the progress of science would be most seriously hindered, and the interests both of animals and man much prejudiced." 2nd. Proposed by Dr. Barnes, and seconded by Dr. Wm. Adams—"That this meeting would urge upon the promoters of the Bill that legislation on this subject should be abandoned for the present session." 3rd. Proposed by Dr. Stewart, and seconded by Mr. Ernest Hart—"That in the event of its being thought necessary for proposed legislation in the future, this meeting would suggest, as an alternative measure, first an Act for the simple registration of persons licensed, and secondly by the Act dealing with the whole subject of cruelty to animals." Mr. Cross accepted the resolutions in question, and thanked the deputation for the expression of their views. A long and technical discussion on the various clauses of the Bill ensued between the Home Secretary and the deputation.

EARLY this year there was organised at Boston, U.S., an "Appalachian Mountain Club" for the advancement of the interests of those who visit the mountains of New England and adjacent regions, whether for the purpose of scientific research or summer recreation. The Club will carry on a systematic exploration of the mountains of New England and adjacent regions, publishing its results from time to time, and will collect books, maps, photographs, sketches, and all available information of interest or advantage to frequenters of the mountains. It will also encourage the opening of new paths, clearing of summits from which views may be obtained, and other improvements. At the same time the Club will encourage the study of comparative geography in general, opening its meetings to contributors on zoological and botanical geography, geology, topography, hydrography, travel, and exploration. The Club is divided into five sections or departments of work—Natural History, Topography, Art, Exploration, Improvement, each with its superintending "Councillor;" Prof. Sterry Hunt is Councillor in Natural History, while the President of the new Society is Prof. E. C. Pickering. The publications of the Club will be very comprehensive and exhaustive; under the title of *Appalachia*, the first part of its journal lies before us. It is mostly occupied with details connected with the formation of the Club, but also contains some interesting papers already read at the meetings. Among these we may mention a paper by Prof. C. H. Hitchcock on the "Atlantic System of Mountains;" another by Mr. S. W. Holman on "Two New Forms of Mountain Barometer," and a third on "A New Map of the White Mountains," by Mr. J. B. Henck, besides the reports of the Councillors for the spring of this year. Altogether great things may be expected from this new club. The Secretary's address is the Massachusetts Institute of Technology, Boston, Mass.

THE "Results of the Meteorological and Magnetical Observations for 1875" at Stonyhurst College Observatory, gives very complete summaries of the monthly means and extremes, which are made more valuable by being compared with the results of the past twenty-eight years. To these summaries is appended a discussion on the hours of occurrence of the daily maxima and minima of temperature. As regards the maxima, the mean for the year is 2 P.M., the monthly extremes being mid-day in December and 4 P.M. in June and July. On the other hand, the minima show two maximum periods of occurrence, one from 4 to 5 A.M., and the other at midnight. The excessively frequent occurrence of the lowest night temperature at midnight, which is given at 747, whereas the largest number for any other hour is 307 at 5 A.M., and the double period of the curve (Plate I.), not being in accordance with the physics of the question, suggest that a faulty method of discussion has been adopted. Evidently, as regards both maxima and minima, each daily period of twenty-four hours has been considered as beginning at midnight, whereas each daily period for the minimum temperatures should extend from mid-day to mid-day. Hence the unsatisfactoriness of the discussion, the only remedy for which is to begin the day, as regards the maximum temperatures, at midnight, thus including in each day the whole time the sun is above the horizon; and as regards the minimum temperatures, at mid-day, so as to include in each day the whole time from sun-down to sun-rise.

WE learn that the Circular of the Committee of the R.A.S. requesting drawings of Jupiter to be made at southern observa-

tories during this year has been efficacious in America at least. M. Trouvelot, who has given much time to the production of astronomical drawings has already secured no less than thirty-four drawings during June. This is important, as Dr. Oswald Löhse, who is studying the surface of Jupiter carefully, declares the changes this year to be of exceptional interest.

In the *Bulletin International* of the Paris Observatory for July 14, Prof. Raulin gives a supplement to his valuable paper on the distribution of the rainfall of Algeria, which was published some years ago, based on fifty-five series of observations brought down to the close of 1874. The mode of the distribution of the rainfall of Algeria is much less varied than that of the south of France, for while in the south of France there are six distinct rain-regions, in Algeria there are only two, the one region being characterised by a very dry summer and a very wet autumn and winter, embracing the less elevated land near the shore and the northern borders of the Hauts-Plateaux; and the other region characterised by a very rainy spring and dry summer, including the Hauts-Plateaux with their borders which skirt the Sahara.

We have received the *Meteorologische Beobachtungen* made thrice daily at the Observatory of the Leipsig University under the direction of Dr. Bruhns during 1875, the whole being carefully reduced, and copious footnotes given each month of the more marked phenomena. The method of publishing only the readings of the dry-bulb and the hygrometric deductions is faulty. All such publications ought to include at least both of the observed facts, viz., the readings of the wet bulb as well as those of the dry bulb.

A fall of meteorites, we learn from *Aftonblad*, took place on June 28, between 11 and 12 A.M., near Ställdalen, a station on the Swedish Central Railway, in the northernmost part of Örebro-län. Several fell, some on the ground and others in a lake. Two were found, one about the size of the fist and weighing 4½ lbs., the other smaller. Eye-witnesses stated that a loud whistling was first heard in the air from west to east, and a light was plainly distinguishable; although the sky was clear and cloudless, thereafter two very sharp reports were heard, the second succeeding the first after a momentary interval, followed by several others less sharp, resembling thunder, after which the falling stones were observed by eight or ten persons; and finally, there was seen in the air a whirling smoke, not very high up. A meteor was observed simultaneously at Stockholm and at other places. At thirteen English miles south-west of Linköping it was seen first in a north-westerly direction pretty high up in the sky, and it then sank down in about ten seconds towards the horison in the west. It had the appearance of a large pear a foot long, which, notwithstanding the bright sunshine, lest behind a clear shining streak of six or eight feet in apparent length, which finally broke up into a multitude of starlike sparks. Here no noise was heard. According to a communication from the Stockholm Meteorological Bureau, there is reason to believe that the phenomena arose from the "kulblixt" (*foudre globulaire*), which generally appears as a luminous round object, and often, on approaching the ground, assumes a lengthened form and a blinding white colour, and bursts asunder, commonly with a loud report. As all who observed the meteor, both in Stockholm and in Södermanland, saw the luminous appearance in the same direction, viz. W.N.W., it is probable that the light proceeded from the main mass of the meteor situated at a very great distance. The phenomenon observed here (at Stockholm) must therefore have been so far an illusion, the object, instead of being, as most people estimated, within a few thousand feet, being actually at a great distance. Later information shows that the phenomenon was visible over a great part of middle Sweden.

The most interesting article in Heft 7 of Petermann's *Mittheilungen* is on the present Turko-Servian war in its ethnographic and historical bearing. The various and very varied elements that go to make up the population over which the Sultan holds sway are pointed out, as well as the fact that the war is not one between Turks and non-Turks, but between Mohammedans and Christians, and especially Christians of the Greek Church. It is thus not a war of races, as many seem to think, a struggle on European ground between Aryans and Turanians, but a religious war, Mohammedanism not being confined to people of Turkish origin. An excellent map to illustrate the various data given in the paper, accompanies the part. There is an article on the geography of the region around the mouths of the Ob and the Jenisei, founded on the information obtained by Nordenskjöld's expedition of last year, of which an account appeared in Nature; this article is also accompanied by a map. Another article describes Largeau's second expedition to Rhadames. Dr. Schweinfurth contributes an account of the expedition conducted by himself and Dr. Güssfeldt to the Arabian Desert from the Nile to the Red Sea, as also of Dr. Ascherson's journey to the Little Oasis (Wah-el-Bah'rīeh) in March–May, 1876. In an article on the "Solution of the Question of the Nile Sources," Dr. Behm refers to the recent circumnavigation of Lake Albert Nyanza by Signor Gessi, and maintains that it is now proved that the true sources of the Nile are Lakes Albert and Victoria, and that therefore the glory of the finding of this ancient quest belongs to the late Capt. Speke along with his still living companion, Col. Grant. Among the Geographical Notices is a paper by Dr. Hann, on "Certain Important Irregularities of the Sea-level."

From the "Ninth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology" (Cambridge, U.S.), we learn that the trustees have resolved to proceed with the erection of a museum building worthy of the magnificent collection they possess. The most important addition to the museum during the year, probably the largest donation ever made to the museum, is that from Peru and Bolivia, collected by and at the personal expense of Mr. Alexander Agassiz. This collection is of great importance in relation to South American archæology and ethnology. Other additions have been made from various parts of America. A General Index to the nine Annual Reports accompanies the present one.

M. Largeau and M. Louis Say are about to undertake another expedition into North Africa; the goal of the former this time will be Timbuctoo, and of the latter Ahaggâr, the culmination of the Central Sahara, and which, it is said, has not hitherto been visited by any European.

In a recent communication to the French Geographical Society, M. Alph. Pinard announced the discovery of a great number of tumuli, quite different from the shell-mounds, on the south and south-east coast of Vancouver Island, which he has been exploring for some time. Out of one he obtained a skeleton with a much deformed head.

The Vienna papers report the death of Mdme. Hulsenstein, a lady who had been maid of honour to Maria Theresa, and lived to the extraordinary age of 119 years. The case ought to be noted as being well authenticated and not grounded merely on idle rumour.

The number of visitors to the Loan Collection of Scientific Apparatus during the week ending July 29 was as follows:—Monday, 3,263; Tuesday, 2,660; Wednesday, 514; Thursday, 459; Friday, 508; Saturday, 3,880; total, 11,284. The usual lectures and demonstrations are given during the present week.

The statue of M. Elie de Beaumont will be inaugurated at Caen (Calvados) on the 6th inst. The ceremony will be interesting, as a deputation from the Institute will be present to do honour to the late perpetual secretary.

THE Senate of the French Republic having rejected the law proposed by the Government and adopted by the Legislative Assembly for conferring honours on students, a mixed jury has been appointed to give diplomas to the pupils of Catholic universities. This body will sit in the Salle Gerson, close to the Sorbonne; the Session will begin next week. The number of candidates is very limited owing to the failure of the new universities.

DR. B. W. RICHARDSON'S proposal for a "City of Health" (the *Times* states), mooted by him in the autumn of last year, is about to be tried practically. A site has been secured on the coast of Sussex, where the sanitary city will be laid out and in due time erected. Dr. Richardson has given his countenance to the scheme, and will supervise the sanitary arrangements, while Mr. Frank E. Thicke will be responsible for the architectural details.

THE Annual Meeting of the British Medical Association commenced on Tuesday at Sheffield, under the presidency of Dr. de Bartolomé of that town.

M. UJFALVY has been entrusted by the French Minister of Public Instruction with a scientific mission, having for its object ethnographical, linguistic, and historical researches in Russia and Central Asia. M. Ujfalvy proposes to set out early this month for St. Petersburg; from thence he will go to Moscow, Nijni-Novgorod, Kazan, and Irkutsk. He proposes also to descend the Volga to the Caspian, and with permission of the Russian authorities to penetrate into Turkestan and the Khanate of Khokand, and as far as Kashgar, returning by southern Siberia.

THE fifth Annual Exhibition of Industrial Arts was opened at the Palais de l'Industrie, Paris, on August 1. This exhibition is remarkable for the large number of historical pictures representing the appearance of Paris at different dates. Each year the several schools of design established by the municipality in different places hold a special exhibition. A great improvement is said to have been noted this year.

SOME French departments are creating agricultural professorships to be paid at the expense of the local budget. One of these has been established by Vienne, one of the most advanced departments in meteorological organisation. The professor will be appointed by competition. He will have to teach the pupils of the normal primary school and to deliver lectures at a number of rural localities. The salary is to be 190*l.* irrespective of special allocations and travelling expenses.

THE additions to the Zoological Society's Gardens during the past week include two Tigers (*Felis tigris*), two Indian Leopards (*Felis pardus*), an Indian Elephant (*Elephas indicus*), two Indian Antelopes (*Antilope cervicapra*), two Horned Tragopans (*Ceriornis satyra*) from India, presented by H.R.H. the Prince of Wales; two Ringed-necked Parrakeets (*Palæornis torquata*) from India, presented by Mrs. Doxat; an Anubis Baboon (*Cynocephalus anubis*) from West Africa, two Australian Crows (*Corvus australis*) from Australia, received in exchange; an Axis Deer (*Cervus axis*), four Chilian Pintails (*Dafila spinicauda*), four Common Teal (*Querquedula crecca*), two Crested Guinea Fowls (*Numida cristata*), bred in the Gardens.

SCIENTIFIC SERIALS

Journal of the Chemical Society, May.—Mr. Francis Jones, F.R.S.E, contributes a paper on stibine. Mr. Jones has investigated several methods of producing this gas, and the one which commends itself to him as the most convenient is the following. A strong solution of antimony in hydrochloric acid is allowed to drop on a considerable bulk of zinc, either granulated or in powder. The resulting gas is then purified by passing it through a very dilute solution of caustic soda, and subsequently dried over calcium chloride and phosphoric anhydride.—Dr. Paul von Hamel Roos gives a paper upon crystallised glycerine. The solidification of this body seems to depend upon the entire absence of water or any other impurity. Dr. Roos is carrying on further investigations with this interesting compound.—Messrs. Beckett and Wright contribute a paper on the action of the organic acids and their anhydrides on the natural alkaloids.—A paper on the use of platinum in the ultimate analysis of carbon compounds, by Mr. Ferdinand Kopfer, of Owens College, Manchester, is the last of the papers read before the Society which appears in this number.—The usual extensive collection of abstracts from papers in British and foreign journals occupies the remainder of this number.

Journal of Mental Science, July.—An article on Kalmuc idiocy is contributed by Dr. John Fraser, with notes of cases by Dr. Mitchell.—In an unsigned essay on John Howard—curious as an application of the necessitarian doctrine to the estimate of character—there is a persistent attempt to depreciate the moral grandeur of the great philanthropist, and to show that his labours have borne much evil as well as good fruit. The essay is accompanied by notes written in an opposite spirit.—Dr. Claye Shaw on the measurement of the palate in idiots and imbeciles, gives evidence that there is no necessary connection between a high palate and the degree of mental capacity of the individual, and that it is difficult to see of what service a palatal investigation can be in affording a clue to the mental faculties.—A very interesting antiquarian and topographical account of the Bethlem Royal Hospital from the year 1247 is given by Dr. Hack Tuke.—Dr. J. A. Campbell presents notes on the reparative power in insanity.—The plea of insanity as set up in two cases of murder is discussed by Dr. Yellowlees, and the difficulties and delicacies of the subject are well brought out.—In an important correspondence between Dr. Bucknill and Dr. Clouston on the relations of drink and insanity, Dr. Bucknill gives his views at considerable length.—An Arab physician on insanity; clinical notes and cases; four neat little reviews of books; the psychological retrospect, English, German, American; with notes and news make up the number.

Sitzungsberichte der Naturwissenschaftlichen Gesellschaft Isis in Dresden, January to June, 1875.—We note, in the Botanical Section, some observations by Prof. Nobbe on root formation of seed plants. The *rôle* of roots being the conveyance of water and mineral matters, and the amount of this depending, *cæteris paribus*, on the extent of surface of young root fibres, he set himself to ascertain this extent in different plants in relation to the surface of the green organs. Plants of Scotch fir, spruce fir, and silver fir, were so grown, that all the root fibres could be collected without loss. The first year's root-product of the Scotch fir (about 12 inches long) exceeded that of the spruce fir about six times, and that of the silver fir about twelve times. The surfaces of the organs above ground were, to those of the subterranean organs, in the Scotch fir as 100 : 477; in the spruce fir as 100 : 168; in the silver fir as 100 : 169. (The entire surface of the first year's plants were respectively, in the order just given, 24,820, 5,690, and 3,903 sq. mm.) It is thus seen how the Scotch fir thrives on sterile, sandy ground, where spruce fir and silver fir perish; also the difficulty of transplanting the Scotch fir may be understood, for a considerable portion of the root is apt to be left in the ground, and the plant does not recover from the loss, nor reproduce the fibres readily.—The geological department contains descriptions of the geology and mineralogy of Vigsnoes in Norway, and of the Kaiserstuhl in Breisgau, Baden.

Jahrbuch der Kaiserlich-königlichen geologischen Reichsanstalt Wien.—In the third and fourth parts of this valuable scientific journal, published during the last six months of 1875, there are a number of articles of very considerable scientific interest. Among the papers on geology, that by Dr. Woldrich, on the old gneiss formation of a part of the Böhmerwald may be noticed as especially worthy of attention; and the same may be said of the memoir which Doelter and Hoernes contribute on the subject of the origin of dolomites, bearing especial reference as it does to the remarkable and well-known rocks of this class in the Southern Tyrol.—The excellent palæontological papers by Dr. Hoernes and MM. Herbich and Neumayr respectively, throw fresh light on those extensively developed tertiary deposits of Eastern Europe, the study of which is, in the hands of the Austrian and Hungarian geologists,

yielding so many interesting and striking results.—The *Mineralogische Mittheilungen*, which, under the editorship of Dr. Tschermak now forms such a valuable portion of the *Jahrbuch*, contains an article by Dr. Hirschwald "Zur Kritik des Leucitsystems," which is sure to be eagerly read, now that so much attention has been excited on this question by the memoirs of von Rath and Scacchi.—Dr. Brezina's contribution to the question of isomorphism, especially in its bearing on the classification of the felspars, is not yet completed, but promises to be one of great importance and suggestiveness.—Dr. Drasche, who, on his way to the Malay Archipelago, whither he is gone to study the volcanic phenomena of that area, has visited the island of Bourbon, sends home an interesting communication concerning its geology, which is also published in the *Mineralogische Mittheilungen*.

Gazetta Chimica Italiana, Anno vi. 1876, fasc. iii.—A considerable portion of this number is taken up by an account of the researches of E. Paterno, of the University of Palermo, on usnic acid as derived from *Zeora sordida*. His investigations induce him to adopt the formula $C_{18}H_{16}O_7$ in preference to those adopted by Stenhouse, Hesse, and others who have interested themselves in this body. In deriving usnic acid from the above source, the investigator discovered two new substances which were invariably present, although in exceedingly small quantities. To these he has given the names zeorin and sordidin (zeorina e sordidina), and assigned the formulæ $C_{13}H_{22}O$ to the former, and $C_{16}H_{18}O_7$ to the latter.—G. Koerner contributes a paper on the constitution of veratric acid and veratrol. The same investigator, conjointly with G. Monselise gives an interesting account of two benzol-bisulphuric acids, and of their relations with other compounds.—In addition to the foregoing, an extract from an account of Prof. F. Selmi's research on atropine is given, and a paper by R. Schiff on the product obtained by bringing into contact with each other acetylic chloride and acetic aldehyde.—F. Sestini furnishes a paper on ethyl santonate, and a few extracts from other chemical journals complete this serial.

Journal de Physique, April.—M. Cazin here gives an outline of his recent researches on the thermal effects of magnetism. The three methods are described by which he measured the calorific effects produced in the core, also his mode of measuring the magnetic quantities, with the electrodynamic balance. In the case of a bi-polar tubular core, the quantity of magnetism alone being varied, by changing the intensity of the current, the quantities of heat generated by intermittences of the current are proportional to the squares of the quantities of magnetism alternately gained and lost by the core. The polar interval alone being varied, by altering the length of the core, the quantities of magnetic heat are proportional to the polar intervals, and consequently to the magnetic moments. In the case of a multipolar tubular core, the successive polar intervals being equal, the quantities of heat generated in the core by the same interrupted current are inversely proportional to the squares of the number of intervals.—The Bureau des Longitudes decided in May last year to rectify annually the Magnetic Map of France; and in this number are shown the isogonic lines, degree by degree, as deduced from last year's observations. There is also a table of the principal towns in France, with the declination and annual variation for each.—A note by M. Potier treats of the conveyance of luminous waves by ponderable matter in motion.—We further note an abstract of researches by MM. Angström and Thalen, on the spectra of the metalloids. They affirm that carbon has only one spectrum, a spectrum of lines; the other spectra attributed to it are due to compound bodies. The same with nitrogen.

SOCIETIES AND ACADEMIES

LONDON

Geological Society, June 21.[1]—Prof. P. Martin Duncan, F.R.S., president, in the chair.—12. On the mechanism of production of volcanic dykes and on those of Monte Somma, by R. Mallet, F.R.S. The author stated that in 1864 he made a careful trigonometrical survey of the escarpment of Monte Somma, especially with reference to the numerous dykes by which the rocks composing it are intersected. He described in detail the phenomena of direction of the dykes, especially as regards the axis of the cone of Vesuvius; to this direction he gives the name of *orientation*. Of twenty-seven dykes ten presented an approximately vertical line, whilst all the rest had a sensible dip or "hade." The dykes are in no cases intersected by coherent beds of lava, but in one instance the top of a dyke was stopped by such a bed. Many of the dykes bifurcated or branched, and frequently two dykes intersected each other at considerable angles. These and other circumstances prove that the dykes were produced at different and successive ages. Many of them were fractured and displaced in consequence of movements of the mass of rock traversed by them; and these dislocations are regarded by the author as indicating the vast extent and force of the internal movements, due principally to gravity, which are constantly taking place in the mass of volcanic cones. These movements greatly influence the position of the dykes, and render it difficult to ascertain that which they originally occupied. The dykes thin out at various heights, and their superior and northern terminations were found not to reach the existing surface, notwithstanding the amount of denudation that has taken place; and hence the author concludes that they never reached the surface of Somma, when it was the wall of an active volcano. The author further indicated a process by which beds or plates of lava descending the slopes of a volcano may change their direction, and becoming embedded in the detritus accompanying or following them, may, to a greater or less extent, simulate dykes, although in this case the two sides of the plate will present the differences always seen in the upper and under surfaces of a bed of lava. The orientation-lines of five or six of the observed dykes were said to pass approximately through the axis of the cone of Vesuvius, but all the rest presented great diversities, and some, when prolonged, would not touch the cone at all. In making a lithological examination of the dykes of Somma, the author directed particular attention to the position of the elongated air-bubbles found in the material of each dyke, considering that the direction of the longest axis of these bubbles would indicate the flow of the material when in fusion. He stated that on the whole the long axes of the bubbles are nearly horizontal or pointing at moderate angles upwards in directions very nearly parallel to the plane of the dykes at the place where they occur. Hence he inferred that the dykes were filled by injection not from below but nearly horizontally. The author further referred to the mineralogical characters of the materials of the dykes, and stated that they are not all composed of leucitic lava; he also mentioned the occurrence of cross columnar structure in some of the larger ones. After referring to the differences observable in the physical condition of the two surfaces of some dykes, the author proceeded to consider the mode of origin of the fissures, which, when filled, constitute volcanic dykes. He maintained that the production of a fissure and its filling with molten matter must have been simultaneous and due to the same cause, namely, the hydrostatic pressure of the liquid lava more or less filling the crater, the pressure originating the fissure into which the pressing liquid at the same time enters; a fissure thus produced and filled will always be widest near the crater, so that if the material of the cone were perfectly uniform the dykes produced will be wedge-shaped. But from the absence of this uniformity and other causes, fissures commenced at the interior and propagated into the mass of volcanic cones can rarely be uniformly distributed round the crater or produced in regular vertical planes in a truly radial direction. Hence the author concluded that it is unsafe to attempt to fix the position of an ancient crater by means of the intersection or concurrence of the lines of apparent orientation of dykes alone. The author stated that the intrusion of volcanic dykes cannot so greatly influence the slope of volcanic mountains as has been supposed.—13. On the metamorphic rocks surrounding the Land's End mass of granite, by S. Allport. In this paper the author described the results of a microscopic examination of certain metamorphic rocks surrounding the Land's End granite, indicating the changes produced by the intrusion of the latter upon clay slate and upon certain igneous rocks. The slates in contact with granite become converted into tourmaline- and mica-schists, and are found to contain crystalline quartz, tourmaline, and three distinct varieties of mica, with occasionally tremalite, magnetite (and andalusite?), and in some localities felspar. Their structure is also changed, the most remarkable changes being foliation with every gradation from nearly straight parallel lines to the most complicated contortions, and concretionary structure by segregation of quartz and mica, the result being a spotted schist. With regard to the origin of the granite of Cornwall, the author said that neither observation in the field nor microscopical study lends any support to the notion that it is a metamorphic rock; but, on the contrary, that there is the

[1] Continued from p. 282.

clearest evidence of former deep-seated volcanic action in the disturbance and alteration described in his paper, and in the enormous number of granitic and felsitic dykes intersecting the country for miles. The mode of occurrence of granite in other localities also seems to him to furnish evidence in the same direction.—14. On the relation of the upper carboniferous strata of Shropshire and Denbighshire to beds usually described as Permian, by D. C. Davies. The author stated his conviction that from the *Spirorbis*-limestone upwards to and including the Permian we have one continuous series of deposits.—15. Notes on the physical geography and geology of North Gippsland, Victoria, by A. W. Howitt. The earliest formation of which any trace is left in this district is the silurian, all traces of any older rocks being removed, probably by the same agencies which have contorted and metamorphosed the silurian slates and sandstones. The surface of all these silurian strata show signs of great denudation previous to the deposition of the Devonian. The period that elapsed between these two epochs was one of volcanic activity, apparently sub-aerial and terrestrial, and representing the Lower Devonian. The Middle Devonian strata consist of shales and sandstones devoid of any traces of volcanic action, which, however, again becomes apparent in the Upper Devonian. The latter consists of conglomerates, sandstones, and shales, interstratified with aqueous deposits. The prevailing red colour of these beds the author suggests may possibly indicate lacustrine rather than marine conditions. The next in the series of deposits present in North Gippsland are of Tertiary age, and rest horizontally on the flanks of the mountains at elevations nowhere exceeding 1,000 feet. At the close of the Miocene and at the commencement of the Pliocene periods the land probably was from 300 feet to 400 feet lower than at present. The fact that different genera of fish are found in the streams flowing from the north and south sides of the Australian Alps indicate the high antiquity of that watershed. These mountains have been formed by the gradual elevation of the land *en masse*, and its equally gradual erosion by the streams and rivers.—16. Further notes on the Diamond Fields, &c., of South Africa, by E. J. Dunn. Communicated by Prof. A. C. Ramsay, F.R.S. These notes are intended to serve as additions and corrections to the author's paper read in 1873.—17. On Chesil Beach, Dorsetshire, and Cahore Shingle Beach, co. Wexford, by G. H. Kinahan, M.R.I.A., &c. Communicated by Prof. Ramsay, F.R.S., V.P.G.S. The author carefully compares the situations, structures, &c., of these two shingle beaches, and points out that their wonderful similarity is due to nearly the same natural causes in each case, but that at Chesil the driftage is due to the flow-tide current augmented by waves caused by the prevailing winds, while at Cahore the driftage is solely due to the flow-tide currents, its effects being modified by adverse wind-waves. The sorting of the pebbles on Chesil Beach is probably chiefly caused by the progressive increase in the velocity of the tidal current as it approaches the nodal or hinge-line of the tide in the English Channel. The author considers that the current due to the flow of the tide has greater drifting powers than wind-waves.—18. Some recent sections near Nottingham, by the Rev. A. Irving, B.A. The author describes a section of the strata exposed during the recent construction of a railway line from Carlton, three miles to the east of Nottingham, through Daybrook, to Kimberley.—19. On the permians of the north-east of England and their relations to the under- and overlying formations, by E. Wilson. The author describes the same section as that noticed in the preceding paper.—20. The section at high force, Teesdale, by C. T. Clough.—21. The distribution of flint in the chalk of Yorkshire, by J. R. Mortimer, communicated by W. Whittaker. The author considers that the present shape of the Chalk Wolds of Yorkshire seems to suggest that they are the remains of an atoll or circular reef, probably one of a chain, rather than the fragment of a vast sheet of cretaceous mud deposited in deep water. He thinks that the flint-bearing and non-flint-bearing chalk areas are in the main contemporaneous in Yorkshire. The chalk without flint contains 4·28 per cent. of silica, whilst the chalk with flint contains only 2·12 per cent.—22. On the mode of occurrence and derivation of beds of drifted coal near Corwen, North Wales, by D. Mackintosh.—23. The Cephalopoda-beds of Gloucester, Dorset, and Somerset, by J. Buckman.—24. Evidence of the subsidence of the Island of Guernsey, by R. A. Peacock, C.E. All round the coast of this island, like that of Jersey, are found tree-trunks and other vestiges of old forest-land now submerged. Passages are quoted by the author from various old historians relative to the former existence of this tract as dry land, the submergence of which probably took place in the fifteenth century. The encroachment of the waters is due to the subsidence of the land, and not, as has been suggested, to the breaking in of the sea through some natural barrier upon some already low-lying district. Judging from the old chart of 1406, the amount of depression is equal to 160 feet.

Iowa

Academy of Sciences, June 23.—Prof. C. E. Bessey, president, in the chair. The following papers were read:—A preliminary catalogue of the lichens of Iowa, by C. E. Bessey; also a preliminary catalogue of the orthoptera of Iowa, by Prof. Bessey.—Mounds and mound-builders, by Dr. P. J. Farnesworth, showing by comparisons in anatomical structure and modes of burial, that the present North American Indians are probably a remnant of the same race that built the mounds.—Dr. G. Hinrichs presented diagrams and maps, based on reports from his 100 Iowa weather stations, illustrating the very severe hailstorm in Iowa, April 12, 1876.—Prof. S. Calvin described seven new species of palæozoic fossils found in Iowa; also a probable new species of elephant found in the modified drift, near West Union. Prof. Calvin also gave notice of the occurrence of the Chemung group (N.Y.) in Iowa, and presented a preliminary notice of the occurrence of the marcellus shales in Iowa.—Prof. F. M. Witter presented notes on the land and fresh-water shells near Muscatine, Iowa.—Prof. W. C. Preston gave the "Thermic Wind Rose for Iowa City, based on three years' observations at Laboratory of Iowa State University."—Prof. Bessey read a note on the relations of light and heat to the colours of Iowa wild flowers.—Prof. Hinrichs showed that the waters from the deep-lying rocks of Iowa more nearly resemble the waters of the sea than the surface-waters Prof. Hinrichs also exhibited a photograph of the Amana meteorite collection, made by him, which photograph is to accompany the catalogue he is preparing.

Vienna

Imperial Academy of Sciences, Jan. 13.—The following, among other papers, were read:—Crystallographico-optical researches on some camphor-derivates, by M. von Zepharovich.—On the abdominal tympanal organs of the Cicada and Grilodeæ, by M. von Graber.—A contribution to the physiology of childbed, by M. Kleinwächter. This refers mainly to the quantities of urine, urea, salt, and phosphoric acid secreted after giving birth, and the relation of such secretion to age.—On the changes wrought in epithelium through formation of sarcom, by M. Tauszky.—Some new form-elements in woody substances, by M. Möller. In a cross-section of *Avicennia africana*, *e.g.*, he finds bright concentric circular lines, which the microscope shows to consist of regular parallelo-pipedal stone cells. Spiral thickening he finds in the libriform of *Protea ericoides*, hort.; so it is not confined exclusively, as Sanio says, to vascular formation. A peculiar arrangement of the parenchymatous elements of *Aquillaria Agallocha*, Reb., is also described.

Jan. 20.—On the heat developed or absorbed in change of volume of bodies, by M. Puschl. For the case of unilateral expansion or contraction of a solid, he gets an expression different from Thomson's formula, and agreeing with Edlund's hitherto unexplained results. He considers the second leading law of the mechanical theory of heat to be in general false, and to be superfluous in the special cases in which it seems confirmed by experience.—On starch-formation in chlorophyll granules, by M. Böhm. *Inter alia*, whatever light intensity suffices for decomposition of carbonic acid, causes also a passage of starch from the stalk into the chlorophyll granules.—Studies on the age of the more recent tertiary formations in Greece, by M. Fuchs.

Jan. 27.—Anatomical and histological notes on *Gibocellum*, a new Arachnid. In outer form it is closely allied to *Cyphophthalmus*, and in internal organisation it furnishes a transition from Phalangidæ to Cheraetidæ.—On the condition of equilibrium of a system of bodies with reference to gravity, by M. Loschmidt. It is shown that in some special systems, in the state of dynamic equilibrium, the mean *vis viva* of the molecules cannot everywhere be the same. Hence Maxwell's law of distribution, according to which this must be the case, cannot forthwith be extended to the case where external forces act on the constituent atoms of the system. The second law of the mechanical theory of heat is not thus invalidated, but certain deductions from it are.

Geological Society, Feb. 15.—The director, M. von Hauer, presented a paper by E. Hussak, of Leipsic, on the eruptive

rocks of Zálasy, near Krzeszowice, which break through sedimentary strata of Triassic age. The author, considering the microscopic structure of these rocks, argues that they are real Trachytes and not Porphyries, as was before supposed. This view is corroborated by the construction of the felspar in regular zones, enveloping one another, the numerous glass-cavities in the latter as well as in quartz, while there exist no fluid-cavities at all, and the abundance of glass and the want of quartz in the seemingly compact base.—Dr. G. A. Koch on the Arlberg tunnel. He showed four sheets of a large and detailed geological map on the scale of 1 : 2000, drawn from nature, representing the nearest environs of the tunnel line on the Arlberg, as it was marked out last summer, and illustrated it by a series of sections and specimen of rock. The whole mass of rock to be perforated by the tunnel belongs to the group of gneiss-phyllite, which just at the Arlberg changes into quartz-phyllite, wherein pure quartz abounds. The tunnel measures 6,470 metres in length, and attains its culmination in 1,423 metres above the sea, running always nearly parallel to the direction of the strata. This tunnel must be led somewhat more than 4·5 kilometres, or about 70 per cent. of its length, through a light-coloured gneiss, which may contain in the least favourable parts about one-fifth of pure quartz. Nevertheless the working of this rock will present no difficulties, as it contains a great deal of felspar, and the vaulting of the tunnel will only be necessary in a few localities where the slates of gneiss are exceptionally very thin. A little more than one kilometre, or about 15 per cent. of the length of the tunnel line passes a nod-slate (Knoten-Schiefer) similar in structure to gneiss, and easily wrought. Scarcely half a kilometre, or about 7 per cent. of the length, belongs to a very hard, small-laminated mica-schist, containing a great deal of quartz, and the rest, somewhat more than half a kilometre, or about 8 per cent. passes a ferruginous mica-schist, including garnets, that abounds more and more in quartz, when coming from Stuben, the Tyrol side of the Arlberg is reached. Dr. Koch also mentioned the difficulties arising from the direction of the strata and the dangerous influence of water in some parts, which are unfavourable to the construction of this tunnel. Finally, he stated that another newly proposed line, though it passes 10·5 kilometres in length directly through the crystalline rocks, would not only afford more security, but also would be less expensive, as the total length of the railroad would be diminished, and the management of it much easier, the culminating point of this longer tunnel lying 108 metres deeper than that of the shorter one.—Dr. R. Hörnes gave an account of his last summer's work. In Austrian countries he mapped the valleys of old and new Prax, Höhlenstein, and Sexter, then the eastern declivities of the Ampezzo Valley; in Italy he examined the valleys of Cadore, Auronzo, and Comelico. The detailed geological map presented by him comprises therefore nearly the same region, which Dr. H. Loretz had described in the Journal of the German Geological Society in 1874.—Mr. F. Gröger spoke about the occurrence of ores of antimony in the Isle of Borneo.

PARIS

Academy of Sciences, July 24.—Vice-Admiral Paris in the chair.—The following papers were read:—On observation of the infra-red part of the solar spectrum by means of the effects of phosphorescence, by M. Edm. Becquerel. Through two vertical slits in a shutter are admitted two beams of parallel solar rays. One beam, traversing a sulphide of carbon prism and a lens, gives a spectrum which is made to fall on a phosphorescent matter; the second beam passing through a white flint prism gives a spectrum, the ultra-violet part of which is thrown upon the infra-red part of the first spectrum. What occurs is this: In the infra-red part of the one spectrum, the impressionable matter excited by the ultra-violet rays has its phosphorescence destroyed, but unequally, giving an appearance of unequal illumination. Not all phosphorescent substances give the effect immediately, and some do not give it. The best substance was found to be phosphorescent hexagonal blende.—M. Becquerel gives particulars of the lines, wave-lengths, &c.—Note on paraldol, a polymeric modification of aldol, by M. Wurtz.—Second note on the reduction of demonstrations to their most simple and direct form, by M. de Saint-Venant.—Theory of the modification of branches to fulfil different functions, deduced from the constitution of the Amaryllidæ, &c., by M. Trecul. Branches may be divided into the terminated or definite, and the non-terminated or indefinite. The definite branches are the leaves, stipules, spaths, bracts, sepals, petals, stamens, and styles, or stigmatic divisions. The indefinite branches are the roots or subterranean branches and the adventitious, the aerial branches properly so-called, the peduncules, the receptacular cups, the ovaries, and lastly the ovules.—Reply of M. Hira to the critique of M. Ledieu in *Comptes Rendus* of July 10.—On the flowering of *Cedrela sinensis* at the Museum, by M. Decaisne. A Chinese tree.—M. Milne-Edwards referred to the loss sustained by the Academy in the death of M. Ehrenberg, who was one of the Foreign Associates on June 27 last.—On the production of electric effluvia, by M. Boillot. Two modifications of apparatus formerly described.—Photometric researches on coloured flames, by M. Gray. He describes a new method.—Note on the radiometer, by M. Gaiffe. He makes one with the vanes painted dull-blue on one side, dull-red on the other; it will turn either way according to the source of light and heat. Solar rays move it one way, a gas flame or radiation from a heated iron plate sends it the opposite.—On radiometers with vanes formed of different matters, by MM. Alvergniat Bros. No. 1 had vanes of silver and transparent mica; No. 2, aluminium and blackened mica; No. 3, aluminium and unblackened mica; No. 4, a radiometer weighing altogether 600 mgr.; No. 5, silver and aluminium; Nos. 6, 7, 8, mica and varnished copper, green, blue, red, and yellow. Effects are described.—On the cause of movement in the radiometer, by M. Sulet. He supposes it to be a difference of temperature in the faces of the vanes. A radiometer with magnetic needle retained an invariable position of deflection four days, the light source remaining constant. Action of condensed gases cannot be admitted here. Decomposition of alkaline bicarbonates, moist or dry, under the influence of heat and vacuum, by M. Gautier.—Photographic inscription of the indications of Lippmann's electrometer, by M. Marey. The opacity of the mercury column is utilised to obstruct, to a variable extent, a slit through which light passes to the photographic screen. The electrometer is somewhat modified. M. Marey shows the curves got from variation of the electromotive force in the heart of a tortoise and that of a frog.—On the existence of alterations in the peripheric extremities of cutaneous nerves in a case of pemphigoid eruptions, by M. Dejerine.—On the physiological theory of fermentation, and on the origin of zymases (soluble ferments), *apropos* of a note of MM. Pasteur and Joubert on the fermentation of urine, by M. Bechamp.—On the malacologic fauna of the islands St. Paul and Amsterdam, by M. Velain.—On the reproduction of dioïc Volvox, by M. Henneguy. Sexuality appears by slow degrees, the male sex before the female, in proportion as the species is exhausted by a sexual reproduction.—On the geological age of some metallic veins, and especially veins of mercury, by M. Virlet d'Aoust.—On the photography of colours, by M. Cros.—On the vertical column observed above the sun on July 12, by M. Guillemin.—M. Larrey presented an Italian memoir by Dr. Minich, "On the antiseptic cure of wounds, and a new mode of dressing." He (Dr. Minich) prefers sulphite of soda to phenic and salicylic acid.

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ERRATUM.—Vol. xiii. p. 155, col. 1, line 15 from bottom, for "mile" read "rule."